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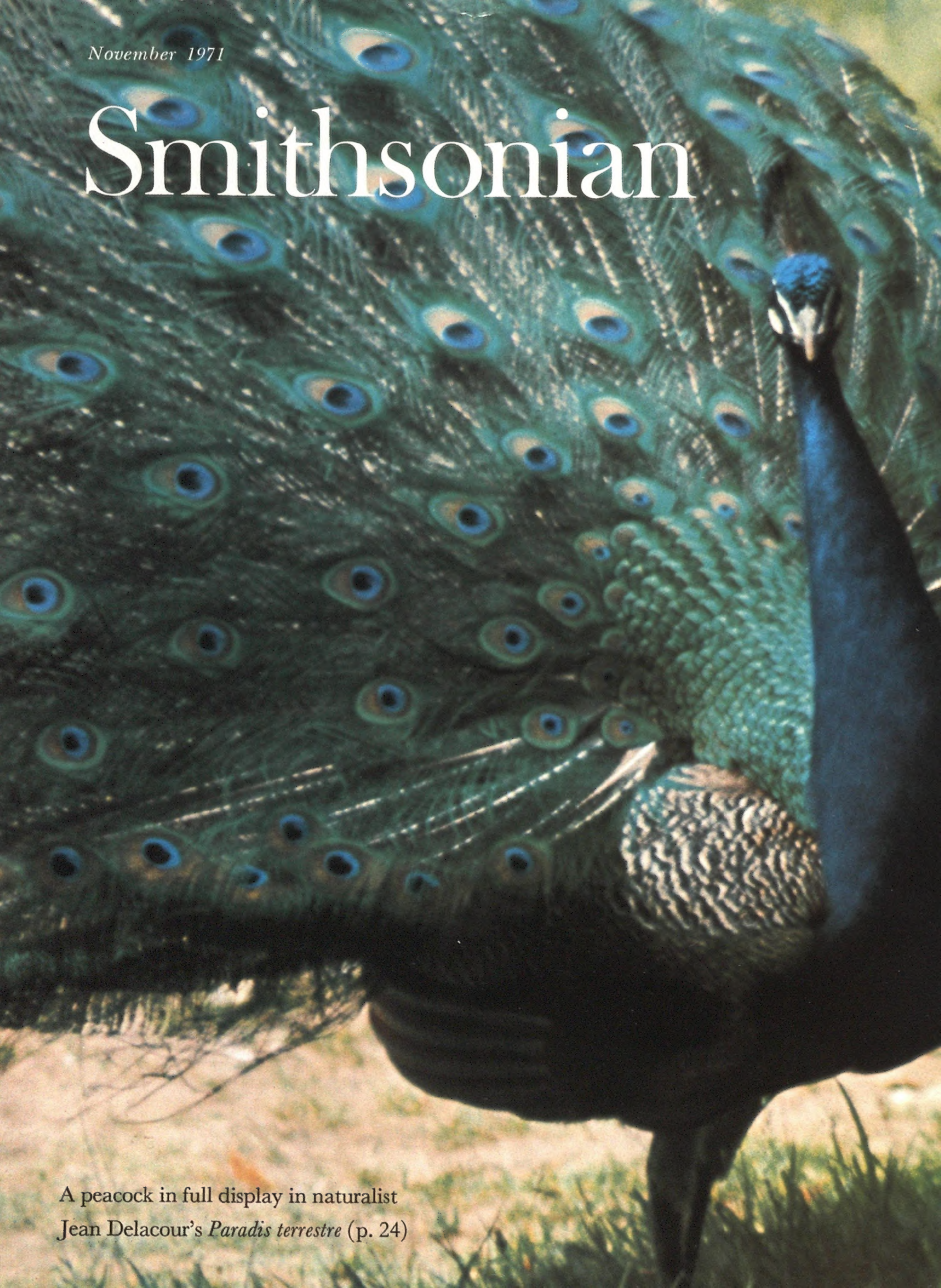
Smithsonian



A peacock in full display in naturalist Jean Delacour's *Paradis terrestre* (p. 24)

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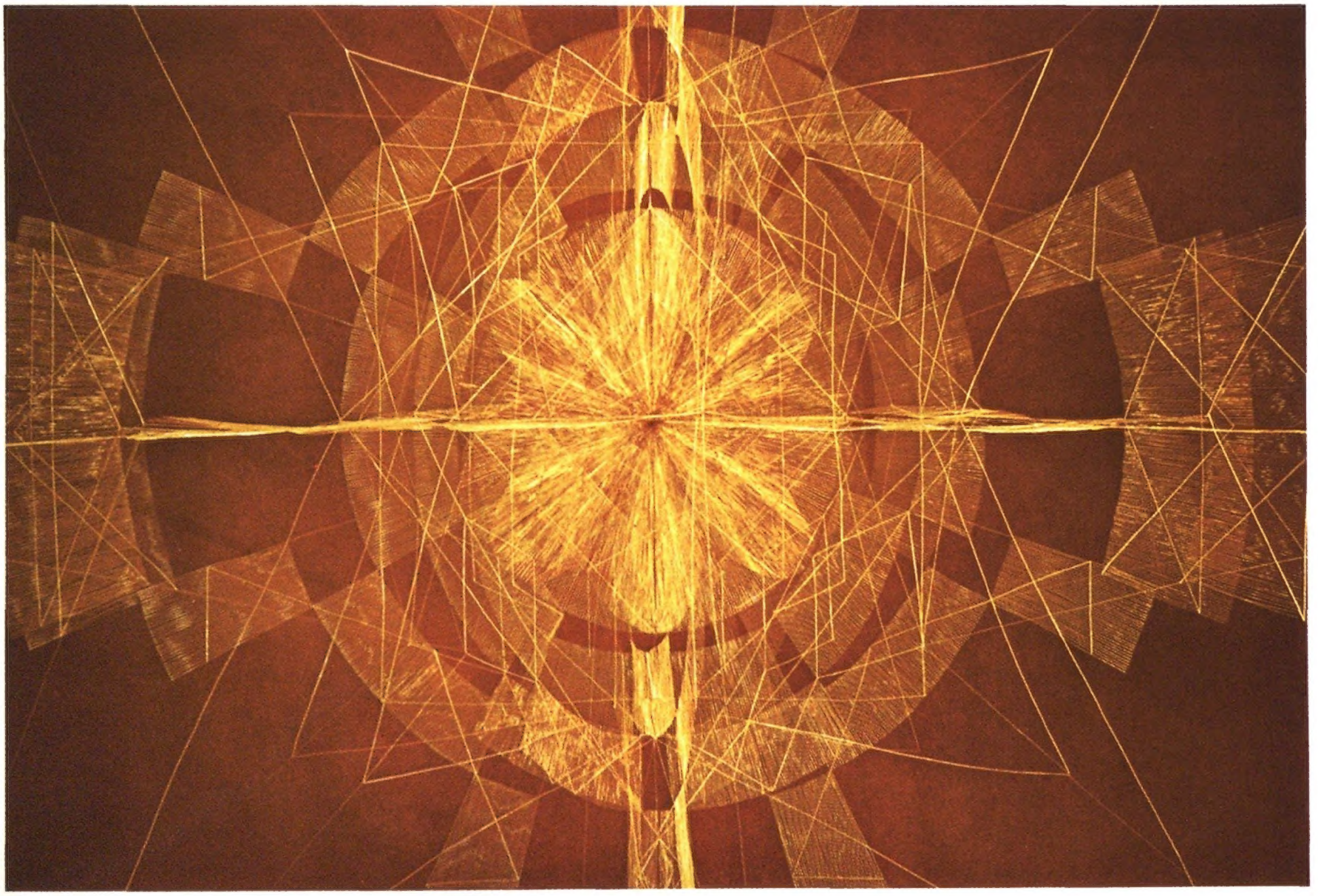

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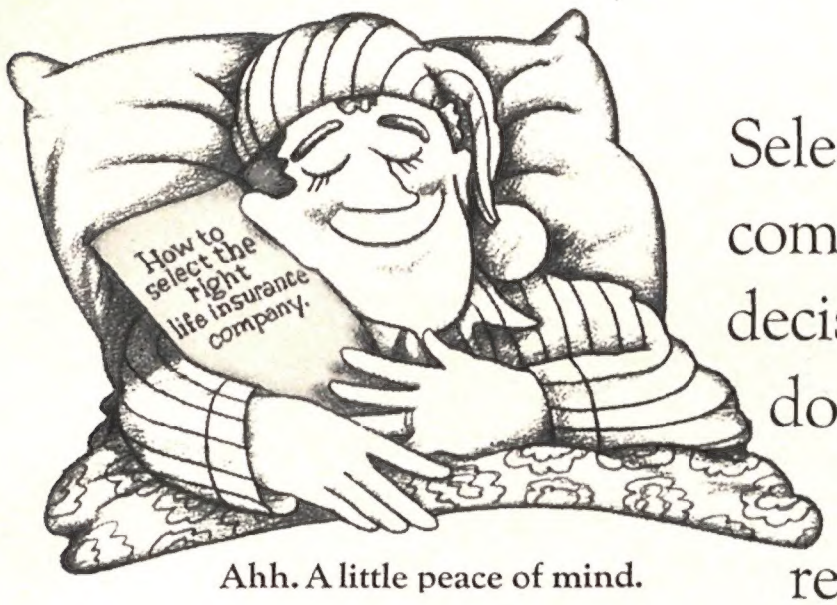

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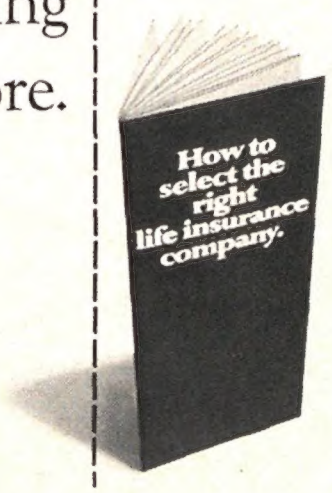

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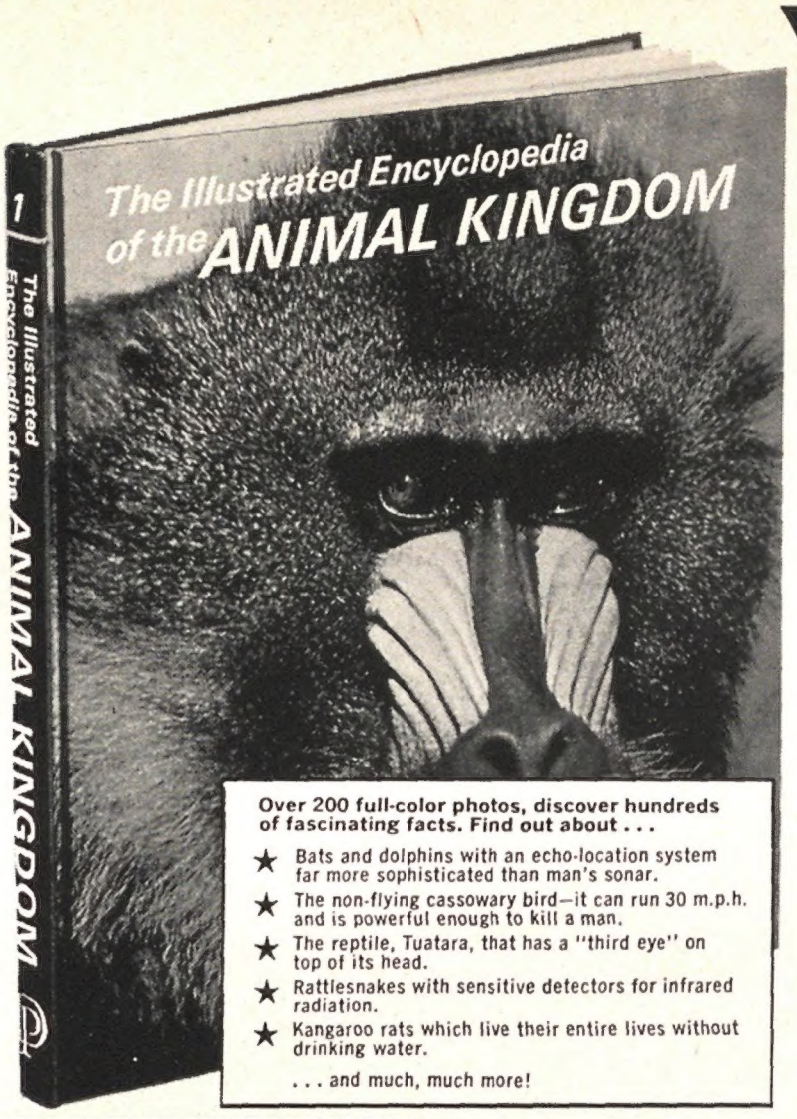

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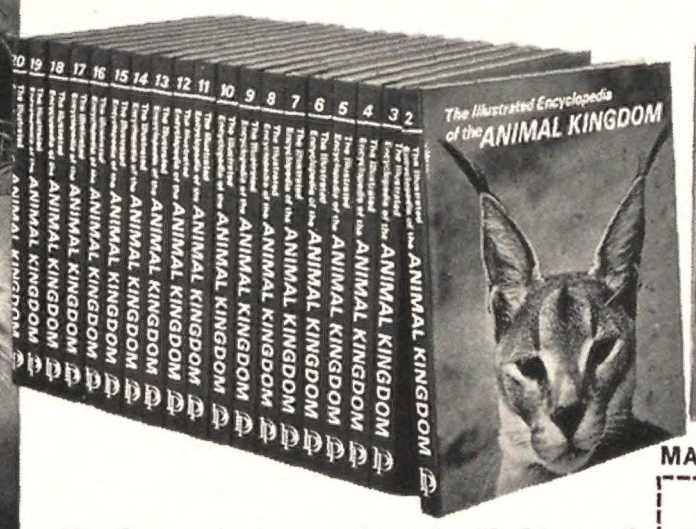

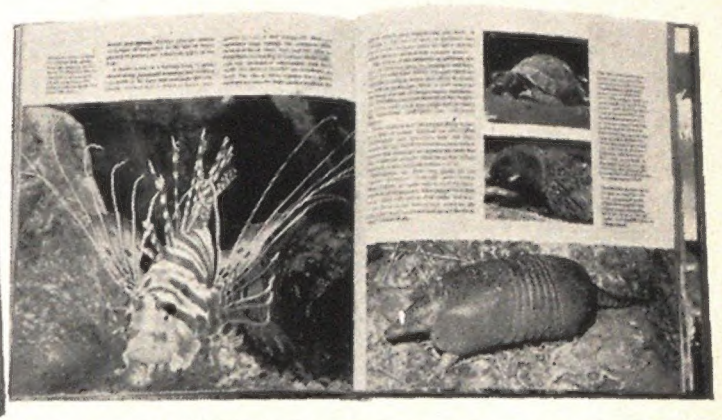

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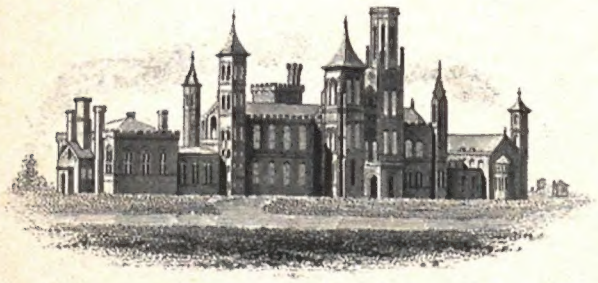
Secretary Ripley's comments

The view from the castle



A new role for ethnologists: to study the ways in which tribal peoples are responding to life as it is today

Nearly a hundred years ago Major John Wesley Powell, hero of the first descent of the Colorado River, created in the Smithsonian the Bureau of American Ethnology, one of the finest developments in the Institution. Its purpose was urgent anthropology—the documenting of the languages and customs of the American Indian before it was too late. Today I am told that there are still more than two dozen Indian languages about which nothing is known; in some cases they are spoken by only a handful of persons who are over 70 years of age, and will thus as languages or dialects go to the grave with them. If this is so we cannot avoid an ultimate responsibility, not merely for the failure to record an aspect of the creativity of the human spirit, but also because we ourselves created the very extinctions which we now mourn.

All over the world today a sadness descends upon us as we think of the ease with which cultures vanish before the onslaught of ourselves and our material artifacts. The very tribes with whom I lived in New Guinea a dozen years ago have now forgotten how to fashion stone axes, and use only steel axes. In another 25 or 50 years, I suppose, they will have forgotten how to use axes at all and be dependent on power saws.

The quarterly of the International Council of Museums has recently printed a report on the consequences of vastly increased tourism on the Island of Bali, the jewel of Indonesia where a distinctive Hindu culture resides, lavishly supporting festivals and pageantry and an atmosphere of creativity virtually unparalleled in the world elsewhere. How long will this culture survive, supported only by the faith of the people, when the religious ceremonies are interrupted and overrun by guided tours of everyone from everywhere else—Americans, Japanese, Romanians, Thais —shouldering in, cameras at the ready, saying to a priest, perhaps: "Move over, Bud, so I can get a picture of that pretty little dancer"?

The sadness of traditional museums of anthropology is that most of the practitioners of the arts of ethnology, painstakingly preserving their collections of material culture, are presiding over legacies of extinction. In the western world most museums depicting the cultures of the other parts of the world celebrate rituals and crafts which remind one of the contents of Egyptian tombs.

But in emerging countries, such as Nigeria, there are contemporary museums of anthropology, although they are not called that; to Nigerians, for example, anthropology is a figment of the imagination of European foreigners. The original museums of anthropology started by the British have emerged as museums of social and technological history to the Nigerians, and as such are a matter of enormous pride.

As with Nigeria, ethnologists must rethink their role as museum curators—whether to settle for the esoteric realms of connoisseurship, or whether to press on and continue to study, as sociologists, the fascinating and uncharted realms of response by tribal peoples to life as it is lived today. Here there are vast resources for the study of survival, adaptation and cultural restructuring in the face of physical and psychic change.

S. Dillon Ripley

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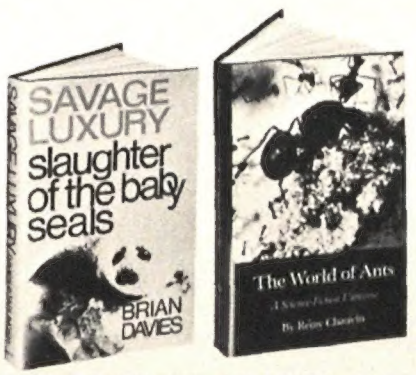

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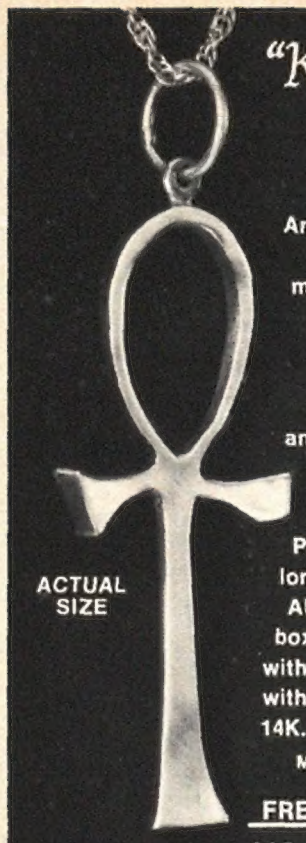

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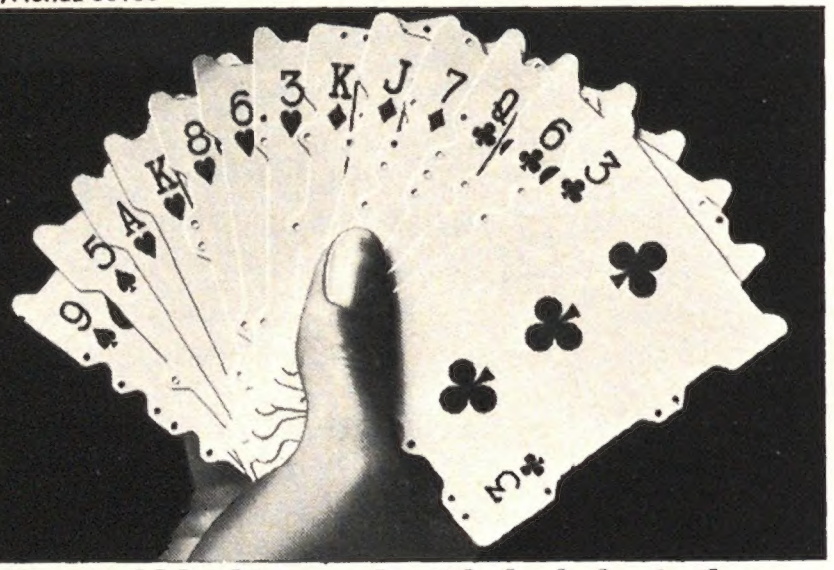

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Letters to the Editor

Smithsonian gems

Dear Sir: Your article, "Royal family of gems holds court at Smithsonian collection" by Paul Desautels in the September issue, is of special interest to me. As a former editor of *National Jeweler*, I was familiar with the now-famous 423-carat Logan sapphire and did much to promote the gem.

Twenty years ago when I was a member of the board of directors of Tiffany and Company, I obtained the sapphire from a leading New York gem merchant, who informed me that he had been commissioned by the owner, Sir Victor Sassoon, to dispose of the stone. I recommended that the sapphire be added to the Tiffany collection of rare gems, but the president decided against purchasing it—even though the requested price at that time was only $25,000.

In the centuries to come, the beautiful gem of Ceylon origin can only grow in interest and value, for I am sure that the sapphire mines of Burma, Thailand and Ceylon will not again yield a crystal from which can be cut and faceted such an awe-inspiring gem.

A. E. Alexander
New York City

Water

Dear Sir: Had Isaac Asimov, author of "How the Greeks' element, water, turned into H_2O," written my chemistry textbook when I was in school, I would have made a better grade and there would probably have been no failures in my class.

Maybe it is not too late. Do you think he could be persuaded to write one for

the benefit of the coming generation?
Charles A. Fitz-Gerald jr.
Gates Mills, Ohio
Dr. Asimov says a publisher is pressuring him to write a chemistry textbook, but he has too many other writing commitments for the time being. He thinks he may get to it one of these days. Ed

Ancient travel

Dear Sir: When I read your article, "After 2,000 years tours have changed but not the tourist," a funny thing happened to me on the way to the Forum! I saw a hauntingly beautiful picture of the Via Sacra from the Colosseum to the Arch of Titus in the Roman Forum, but, strangely, someone had labeled it "Rome's splendid Appian Way."

Author Lionel Casson gave us a marvelously intriguing portrait of tourism some 20 centuries ago.
Karl V. Krombein
Arlington, Virginia
Mr. Krombein and other readers are correct about the photograph showing the Via Sacra. The old Appian Way terminates near the Colosseum. Ed.

Dear Sir: While I enjoyed your article on travel in ancient times, I disagree with your translation of Martial's epigram about the innkeeper—it completely conceals the point of Martial's jest about the scarcity of water in Ravenna. The epigram says:

Callidus imposuit nuper mihi copo Ravennae: Cum peterem mixtum, vendidit ille merum.
(A clever innkeeper recently gypped me at Ravenna: When I ordered *mixtum,* he sold me *merum.*)

Mixtum is wine mixed with water; *merum* is pure wine. The point of the jest is that water—good drinking water—was so scarce that the *copo* saved money by serving pure wine. This should be an interesting commentary on the ecological problem today.
Arthur Eichelberger
Philadelphia, Pennsylvania
Author Casson says: Mr. Eichelberger is quite right. In my notes, I found the translation of the epigram that directly precedes the one I included in the article. It runs:
At Ravenna I'd sooner own cisterns
than cultivate the vine,

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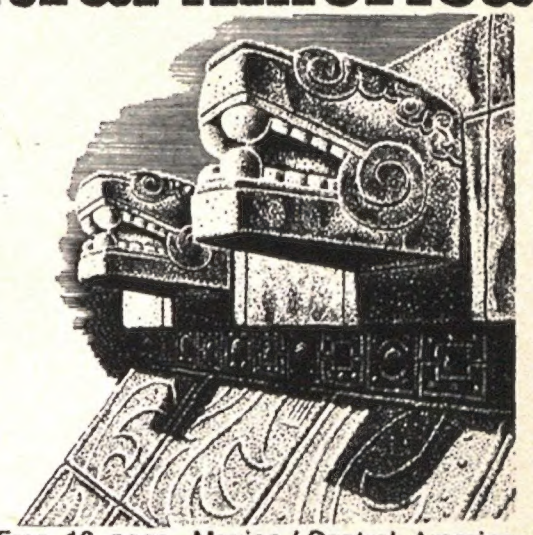

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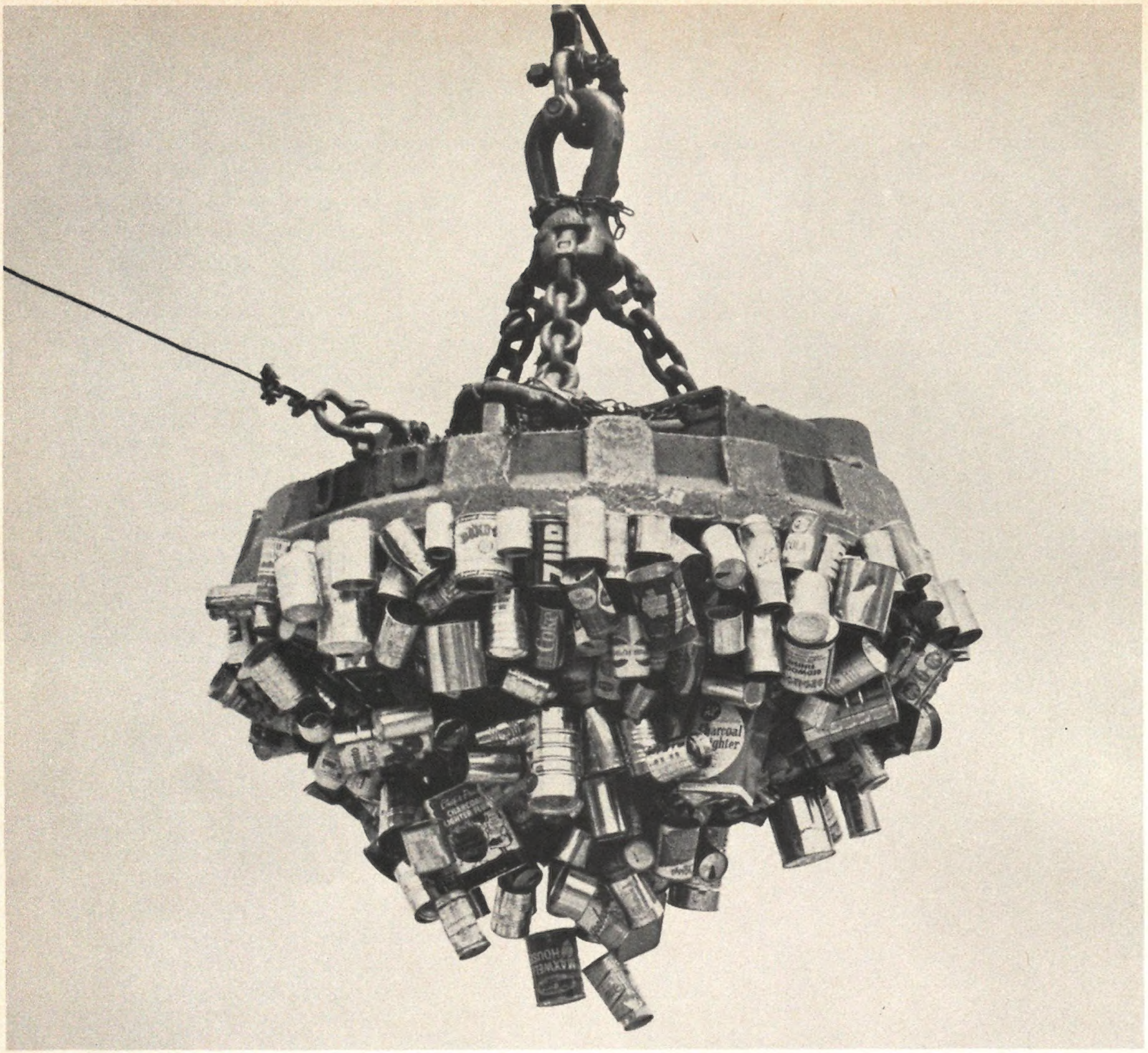

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because there I could make me more money selling water than wine." Ed.

Biological controls

Dear Sir: Dr. Clifford Berg's article on Sciomyzidae was particularly interesting to me, since my field is aquatic malacology. Dr. Berg is to be congratulated on his concern for the possible adverse effects of introduced marsh flies on Hawaii's magnificent native snail fauna.

I sincerely hope that the zeal for stopping schistosomiasis does not result in the destruction of native snail faunas—though, as the author points out, a successful biological control operation results in a self-perpetuating population of the "enemy." This is important because today's "enemy" snail species may itself be discovered to have especially valuable characteristics at a later date, perhaps as a biological control organism on a species of plant which otherwise would grow so fast as to become a nuisance organism.

Therefore, the biological control concept seems to be especially valuable, since it will not wipe out a target species completely, and the target species does not become genetically immune to a biological predator.

Carol B. Stein, assistant curator
Museum of Zoology
The Ohio State University
Columbus, Ohio

Rappahannock dam

Dear Sir: We hope that your article by Rice Odell, "You can't shoot the rapids on a man-made lake," will have wide circulation and influence in stopping the inundation of the Rappahannock and Rapidan Rivers.

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F. W. Osborne
Tucson, Arizona

Continued on page 11

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PROFESSION: International Opera Singer

HOBBIES: American Antiques, Collecting old engravings of opera singers, compiling a library of musical biographies.

LAST BOOK READ: The American Singer

LAST ACCOMPLISHMENT: Successful critical debut as "Delilah" at La Scala.

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Cinderella

Dear Sir: Patrick Ryan's laudable column on the lamentable state of women's feet contained the Cinderella myth, along with a great deal of common sense.

The rags-to-riches story all comes about because Cinderella's foot fits a glass slipper, which must have been too big to begin with since it fell off. But that's another matter.

The 1929 *Encyclopaedia Britannica* says that the slipper wasn't made of glass; it was made of fur. The French editions of *Cendrillon* refer to the slipper as "*en vair*," of squirrel fur—not "*en verre*," of glass.

Rey Barry
Charlottesville, Virginia

Mr. Barry is correct. The Encyclopaedia Britannica *and other sources report a mistranslation in the ancient fable—it was a fur slipper, not glass.* Ed.

Portraits of the stars

Dear Sir: Monroe H. Fabian, in his article "An all-star stage troupe . . ." names the first theatrical productions given in America in Spanish and in English. But he overlooks the French to the north. In the year 1605 (60 years before the first English production) in what was then Port Royal in Acadia, the versatile Marc Lescarbot (he has been called "the French Hakluyt") wrote and produced *Neptune's Theatre.*

This drama was a masque for 11 characters, presented for the entertainment of Samuel de Champlain and others at France's first outpost in the New World.

George W. Jeffers
Farmville, Virginia

Author Fabian dealt only with early theatrical productions in what is now the continental United States. Marc Lescarbot wrote and presented Neptune's Theatre *in 1606 at Port Royal in the Bay of Fundy to celebrate the safe return to the settlement of its owner, the Seigneur de Poutrincourt.* Ed.

Filene Center

Dear Sir: In your article, "Mrs. Shouse's new pleasure dome," I noticed two discrepancies. There is no law barring the National Park Service from engaging performers, but we do have an agreement leaving that responsibility to the board of

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We have very little time and perhaps too few tigers left with which to work. But we must act now and we need your help.

SAVE THE TIGER

The print above is of an oil painting of Mohini and cub, the Smithsonian's rare white Bengal tiger, painted by Ed Bierly who has signed and numbered a special edition for those persons sending a $100.00 check ($90.00 of which is tax-deductible), payable to the *Save the Tiger Fund*, c/o National Zoological Park, Washington, D. C. 20009. Your 24" x 30" presentation print will be mailed immediately along with our appreciation for helping to

SAVE THE TIGER.

directors of the Wolf Trap Foundation. Also, there are no restrictions preventing the Park Service from constructing new buildings.

The agreement with the Wolf Trap Foundation has worked most amicably, and the high-quality performances (70 in all) have attracted a total attendance of more than 310,000 to the Filene Center this first season.

George Berklacy
Assistant to the director
National Park Service
Washington, D.C.

In addition to the points Mr. Berklacy has made, we are grateful to Mrs. Shouse herself for setting the record straight on the following matters which have come to SMITHSONIAN'S *attention since the article appeared.*

Her grandfather, William Filene, was not "wiped out in the 1880s" but did suffer business reverses that made it necessary for her father and her Uncle Edward to drop out of school and go to work in the specialty store.

Wolf Trap Farm was originally 52 acres, not 150 acres, and it was to Fairfax county rather than the governor of Virginia that the land was first offered.

Although in its first season Wolf Trap did not have "a major orchestra as a permanent fixture," no decision has been made for the future. And there has already been some "encouragement of young composers": American University offered a course for them during the summer, and members of this group took part in seminars at the Filene Center.

Mrs. Shouse is not a Republican; she is a life member of the Woman's National Democratic Club of Washington. And the "large, hard-working staff" referred to is not her personal staff but that of the Wolf Trap Foundation.

Mrs. Shouse feels that the description of her association with the National Symphony gives an unfair impression: "I have consistently taken the part of the musicians at board meetings up until the last strike, but could not sympathize with many of the demands made at that time."

As the article pointed out, there is no question of "the intensity of her commitment and generosity to the orchestra, and her exertions on its behalf." There is also no question that in its first season, now ended, the Filene Center has already immeasurably enriched the cultural life of Washington. Ed.

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By Wilson Clark

How to harness sunpower and avoid pollution

As fuel resources dwindle and the real energy crisis dawns on an electricity-hungry world, solar energy has begun to appear practicable

"Mines bear no second crop," said Dr. Preston Cloud of the University of California, Santa Barbara, at the annual meeting of the American Association for the Advancement of Science two years ago. Dr. Cloud was describing the consequences of the voracious consumption of mineral raw materials in the United States, a path leading us to the day, perhaps only a century away, when the key feedstocks of our industrial civilization will be gone.

He predicted that by 2042, "which is only as far into the future as the invention of the airplane and the discovery of radioactivity are into the past," the United States will have a secure supply of only three of the 20 mineral commodities necessary for industrial development. Of those three—molybdenum, iron and coal—even the future supply of iron is in question.

Energy, the handmaiden of Man's progress through the centuries, is in the deepest trouble. Demand in the United States for *all* sources of energy is rising at a steady five percent per year, and demand for electricity alone is skyrocketing at nine percent per year—it is doubling every decade. Continuation of this trend is clearly impossible, given the current means of obtaining energy. In a few decades there will be no oil for conversion to electricity or for transportation, nor will there be any natural gas, the cleanest burning fossil fuel. (And when the fossil fuels are gone, so too will be their other uses, such as conversion into plastics and other synthetic materials.) The one other alternative, power from the fissioning of the radioactive isotopes of uranium, is fraught with problems—not only the possibility of contamination of the Earth by radioactivity, but also the depletion of finite uranium deposits.

This is the energy crisis, a crisis which has little to do with the summertime difficulties of power companies or the political considerations of importing Mideastern oil. It requires recognition of the fact that our energy resources are dwindling, the bitter realization that at some not-so-distant hour the party will be over. Yet America has no "energy policy," and there have been few credible attempts made to develop one. One of the reasons for this may be despair. Another is faith that some untried or unknown future technology will save us in the nick of time. Work is now progressing in the United States to make synthetic gas from coal as well as to develop advanced nuclear reactors, called "breeders," which may stretch uranium sources by more efficiently using nuclear ore. Yet both of these

Wilson Clark is Washington representative of the John Muir Institute for Environmental Studies and also a frequent contributor to Energy Digest.

Hot gas of a solar prominence streams to surface of the sun, which may yet prove a source of free fuel.

alternatives involve grave hazards to the environment of Man.

The continued use of vast quantities of coal to power our civilization threatens despoliation of the earth through strip-mining and deadly acid drainage into streams and rivers, not to mention the death sentence society imposes on the men who still toil in the underground mines. Nuclear power is perhaps even more dangerous: No known way has been found to dispose safely of radioactive wastes, the ultimate pollution, while public safety is vulnerable to the possibility of abnormal operation of the nuclear plants.

Another alternative, the hoped-for achievement of nuclear fusion, would use the principle of the H-bomb to make power and would be fueled by the deuterium atoms in ordinary seawater. But this process remains theoretical, and may never become practical.

In spite of all these schemes, the greatest energy source of all has not yet been tapped; in fact, few men are aware of its potential, even though they themselves are powered by it: the sun. Though largely ignored in the high councils of energy production and planning, the large-scale conversion of solar energy into useful forms of power appears now to be feasible.

Many scientists have long been working on solar engines and heating devices. (See "Dr. Abbot: the wizard in the Smithsonian Tower," SMITHSONIAN, October 1970.) Among them is Dr. Erich Farber, director of the University of Florida's Solar Energy and Energy Conversion Laboratory. For the last 17 years he has been developing water heaters, space heaters for houses, outdoor ovens, water distillers, refrigerators, air conditioners, small engines, water pumps and turbines—all powered by simple collectors of ordinary sunlight. The laboratory's solar hot-air engines and solar water-distillation units have been especially beneficial to underdeveloped countries needing small devices to distill fresh water and pump water for irrigation.

Farber points out that thousands of solar water heaters have been installed in buildings and homes in Florida. In these units, a solar absorber, a simple glass-covered flat pan painted black and containing water pipes, is mounted on the roof. As the sun heats the water pipes, hot water flows by free convection (requiring

no pumps) to the top of an integrated water tank. Cold water from the bottom of the tank replenishes the supply in the solar absorber pipes to complete the process. To ensure that an adequate supply of hot water will be available during the night hours or for periods of bad weather, a large storage system is needed: The average family-sized water tank for Florida use is of 80-gallon capacity. Up to 48 square feet of roof space is used for the absorber.

Some units that Farber has observed in Florida have been in operation for up to 25 years; even with broken glass surfaces, they still perform to the satisfaction of their owners. None of Farber's systems is dependent on bright sunlight. His solar collectors use diffuse solar radiation, enabling the heaters, air conditioners and engines to function even on cloudy days.

Although no solar houses have yet been constructed in the United States which employ sun-powered air conditioners, at least 20 experimental houses have been constructed which use solar space heaters and, in some instances, air coolers. In most cases, these houses use supplemental power from conventional petroleum or electrical sources, but the solar units have successfully performed most of the work.

For example, Harry E. Thomason of Washington, D.C., has built three solar-heated and cooled homes. His first Washington winter in a three-bedroom solar-heated house built 12 years ago brought temperatures near zero and 25 inches of snow, yet he used only $4.65 worth of supplemental fuel oil to stay warm. The solar heating-cooling system cost about $2,500 to install, or $1,000 more than a conventionally fueled unit. Since his fuel bill has been negligible since then, one may guess that the system has proved its worth.

Mass-producing houses and electricity

Custom-crafted homes are one thing. Developing plans for modular mass-produced solar houses, which would incorporate solar heating units with high-quality insulation to prevent heating-cooling losses, is the goal of Dr. Maria Telkes, a thermal storage expert and solar energy pioneer at the University of Pennsylvania. She aims to have complete plans ready for modular homes by the spring of 1973 for testing the following winter. "These solar houses must be factory-built so that the initial costs of installation will be no more than comparable houses without the solar heating systems," she says.. The goal is to develop houses that can be located anywhere in the southern two-thirds of the United States and will use solar energy for at least 90 percent of the residential heating needs. Solar air-conditioning units are to follow.

Solar engineers and scientists across the country agree that the rapid development of solar-heated houses with their huge fuel savings will help "sell" the public on the key idea—that ancient dream of using solar energy to power our civilization. How do you convert sunlight to electricity?

Ninety years ago English physicists first noted that sunlight striking the element selenium produced electricity, but it was not until the mid-1950s that efficient conversion of electricity was achieved by silicon cells. Silicon cells are capable of converting sunlight to electricity at seven to ten percent efficiency, a highly favorable rate compared to the one percent (and less) efficiency of selenium.

The space program has sharply spurred the development of photovoltaic technology, as it is called. Thousands of silicon cells are now scattered through space, powering various measuring and transmitting instruments. Mosaics of these tiny cells have no moving parts and generate a continuous stream of electrical current until the effects of weathering and radiation stop

One of three Washington, D.C., solar homes built in the 1960s. Sunlight collected on the roof provides two-thirds of heat required for winter.

them—after years of providing dependable fuel and pollution-free operation.

A number of scientists have now begun to explore the possibility of providing power for Earth through space-related systems. One such man is Dr. Peter Glaser, head of the engineering sciences department of Arthur D. Little, Inc., a Boston consulting firm. Three years ago Glaser startled the scientific community with a plan to supply ten million kilowatts of electrical power in the United States from a solar power station in synchronous orbit 22,300 miles above the Earth.

The sun's energy would be constantly collected by a 25-square-mile solar collector consisting of solar cells on a satellite which would weigh at least five million pounds. Electrical energy from the solar cells would be channeled through a two-mile connecting cable to an antenna which includes a microwave generator. The current would be converted to a microwave beam and sent on its long journey to Earth.

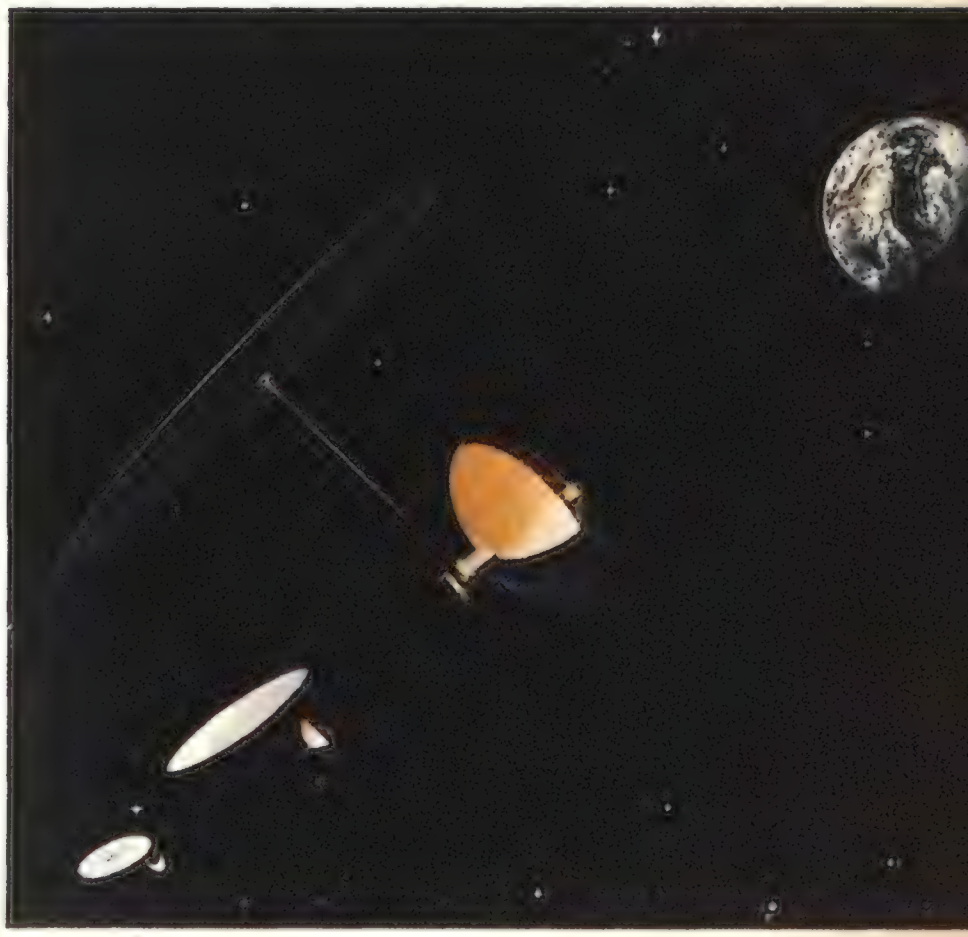
At a 36-square-mile land-based collecting station, a nine-square-mile antenna grid and a microwave rectifier would transform the microwave signal to DC power and transmit it along established power lines.

A 90-percent efficiency is claimed for the land-based conversion of microwaves to DC current, approximating some claims for nuclear fusion power (if fusion power is ever developed). In contrast, present electrical power plants, both fossil- and nuclear-fueled, have overall efficiencies between 30 to 40 percent, and produce pollution along with current.

The only detrimental effects on the environment of Glaser's system might arise from the microwave beam focused on Earth, but according to a technical report on the project, the beam would have an average power density less than a tenth of the strength of solar radiation on Earth.

Cost projections for the scheme indicate that the station's total installed value would amount to no more than $500 per kilowatt of electrical capacity, compared to today's rising costs of $200 to $400 per kilowatt of electrical capacity for the building of fossil and nuclear power plants.

Glaser's estimate, however, is contingent upon major technological developments in reducing the expense of the solar cells needed for the space platform. Today, as much as two million dollars per kilowatt of electrical capacity is spent by NASA to power big satellites with solar cells. Glaser's project calls for spending only $300 per installed kilowatt for the cells alone . How will this be possible?



To generate electricity from the sun, one plan calls for huge satellites with solar cells that would beam a current of microwaves to Earth.

For the last ten years silicon cell costs have been about $200,000 per kilowatt for space applications. The fragile cells are still produced by hand-crafting techniques similar to those used in making jewelry. Space-grade silicon is grown in single crystals, cut with diamond saws for placement on the thin substance of the cell's base, and is almost 100 percent pure.

What is needed is the development of a sizable industrial base to begin mass-producing solar-cell components to bring costs down. William Cherry of NASA's Goddard Space Flight Center foresees a highly automated solar-array assembly line, where a roll of raw material for the thin photovoltaic cell structure is fed into one end of the machine and a finished "solar blanket" emerges.

Cherry is convinced that by the use of such highly automated processes, the solar cell matrix will cost a mere 50 cents per square foot. He points out that NASA's principal supplier of coated-glass covers for solar cells, the Optical Coatings Laboratory in Santa Rosa, California, has developed a high-volume machine for coating glass. The machine, called MAC (Multilayer Automatic Coater), could probably be used to reduce costs several orders of magnitude lower than current cell costs, if sufficient demand existed. Another immediate way to reduce costs would be to use less pure silicon, which would impair the energy conversion efficiency of the cells somewhat, but would be far cheaper.

Another technique in the use of solar cell "arrays" was developed by Eugene Ralph of the Heliotek Division of Textron Incorporated. The silicon elements in his arrays are in individual nests, surrounded by reflectors to concentrate more sunlight on the silicon.

These arrays have boosted the power output of round silicon cells two-and-a-half times that expected from the cells without reflectors. Ralph envisions large-scale production of more advanced concentrator

In the Meinel plan, 1,000 such plants with collectors (left) more efficient than solar cells, could supply most of our electricity by 2076.

designs to increase the power output 125 times that of ordinary silicon cells.

The logistics of a space solar plant are complex and it appears now that land-based solar technology can produce higher efficiencies than had been thought. NASA's Cherry has advocated building electrical facilities using solar-cell arrays on land, as well as in space. To meet the total U.S. power needs of 1990, he calculates that about one percent of the total land area of the continental United States would be required for the mosaic of solar-cell arrays—just over 31,000 square miles which is about the same quantity of land currently planted in oats in the United States. "By 'farming' with solar cells, we could turn a lot of virtually useless land into some of the most productive land in the country, with something approaching a $2,000 per year profit per acre," Cherry says.

In a typical Earth-based installation, a one-square-mile solar-cell power plant producing 60,000 kilowatts would cost about $100 million to build, operate and maintain over a 20-year period. This assumes that a dependable and cheap solar cell can be devised, as well as materials capable of withstanding years of weathering and exposure to the sun's radiation (plastic sheets resistant to ultraviolet light have been proposed).

An essential element of any Earth-based solar power plant is its energy storage system. Not only must nighttime demand be accounted for, but also periods of poor weather which circumvent efficient functioning of solar cells. Cherry proposes massive lead-acid storage batteries like those used in telephone exchanges. The batteries for each one-square-mile plant would store one million kilowatt-hours of electricity, a four-day supply for ten thousand homes in wintertime.

Standard arrays of solar cells like this produce electricity at ten-percent efficiencies. If reflectors are added, the efficiency can more than double.

The problem of storing energy

In another scheme—that of two University of Denver scientists, Jack E. Rink and Jack G. Hewitt jr., for a large-scale solar-cell facility for southwestern Arizona —the energy storage problem would be handled by pumped-storage units comparable to those in use now in some conventional power plants. Electricity from the solar array would be used to pump water into high reservoirs during periods of low demand. When needed, the water would be released, falling through electrical generators into a lower lake or river.

An ambitious plan to initiate large-scale use of solar energy as well as to provide a practical answer to America's critical natural gas shortage has been proposed by Dr. Norman C. Ford and Dr. Joseph W. Kane of the Department of Physics and Astronomy of the University of Massachusetts. They would develop an enormous solar furnace, which would heat water to 1,500 degrees C. by focusing sunlight on a boiler through a complex of inexpensive plastic lenses. At such a high temperature, some of the water vapor would be dissociated into pure hydrogen and oxygen.

According to them, "if one can selectively pump the hydrogen out as fast as it is produced, the goal will have been accomplished," and the hydrogen could then be used as high-grade fuel to supplant ordinary natural gas. Additionally, "the generation of hydrogen circumvents two of the serious problems associated with most solar power schemes in that the 'energy' is both storable over long periods and transportable over long distances, as electricity, for example, is not."

The most innovative and exhaustively researched idea for the large-scale conversion of solar radiation to electricity on land has been proposed by two astronomers, Dr. Aden Meinel, Director of the Optical Sciences Center of the University of Arizona, and his wife Marjorie. The Meinels propose the construction of 1,000 land-based solar power stations each capable of producing 1,000 megawatts (*i.e.* one million kilowatts).

This so-called National Solar Power Facility would be located in the largely uninhabited desert region of

the lower Colorado River basin, between the Mexican border and Las Vegas, Nevada. It could, the Meinels say, supply most of the United States' electrical needs in 2076, as well as those of northern Mexico.

Since the power plants would use conventional steam turbine technology, they would have to be cooled. The Meinels propose to do this by pumping salt water from the Gulf of California through aqueducts built in Mexico's Sonora province. The cooling process would heat the water enough to desalinate it. The steam would be collected and condensed, producing 50 billion gallons of fresh water a day. That is enough fresh water to supply 120 million people in what is now a chronically water-hungry region.

The most encouraging aspect of the Meinels' proposal is the efficiency of the overall power system. Counting all energy losses, the predicted efficiency of sunlight conversion to electricity is just over 30 percent, or about two to three times that expected from a land-based solar power plant converting electricity by silicon cells. The secret of this remarkable efficiency is the design of the solar collectors.

A typical collector would consist of a tubular heat absorber mounted inside a glass envelope; the glass would be coated with a thin multilayer optical coating to transmit sunlight effectively as well as trap infrared radiation and reflect it back to the heat absorber.

Heat energy would be transferred from the system's absorber to liquid metal channeled through the collector to a central thermal storage facility, where the heat (1,000 degrees F.) would be stored in a huge tank of molten salt. The heated salt would then supply the energy necessary to drive steam turbines for ultimate production of electricity.

Ten percent of the desert

The entire facility calls for some 13,000 square miles of desert area, in which the 1,000 individual plants would be placed (see map). There are more than 100,000 square miles of desert in the western United States, and the Meinels want about ten percent of it.

Certain environmental questions stand out. For each gallon of fresh water produced, a gallon of brine would be rejected to the Gulf of California. In time, this additional salt could upset the estuarine ecology of the Gulf, but the Meinels' theoretical studies indicate that if the brine is pumped far enough out into the Gulf, natural turnover of the Gulf's waters will dissipate it sufficiently.

Land use for the facility itself, its supporting aqueducts and its underground transmission lines may also prove to be a problem. But one wonders if it wouldn't be worth trading desert land for a virtually nonpolluting solar-power complex, rather than continuing to destroy the Colorado River basin by hydroelectric projects and filthy coal-electric power stations, such as the notorious Four Corners center which itself involves strip-mining large areas.

Of all proposals for the development of a land-based solar electric project, the Meinels' has the fewest technological and economic worries. The cost of electricity from one of their plants operating 20 years in the future is slated to be approximately five mills per kilowatt hour, which is competitive with today's market. This single fact may get the whole project moving.

But the wheels of change are slow to foster and finance growth of the essential groundwork necessary even to get the first modular solar home into operation. President Nixon referred to solar energy in his June 1971 address on energy problems, but needed money has not yet been invested in the key research projects necessary to realize the solar dream.

A few corporations and power companies have begun to take their first, tentative steps toward the development of solar energy on a large scale. But significant private investment in sun power is a long way off, and most bets for its rapid development still rest with government funding.

At present, federal expenditures for all energy re-

The 1,000 plants of the Meinels' solar facility would occupy some 13,000 square miles of the desert (white areas) flanking a new urban area (green).

Aqueducts (see map) would snake through mountains, carrying salt water for the cooling process which would desalinate the water.

search and development amount to about $500-$600 million. Of this, nuclear power plant development takes about 85 percent. What is left is devoted mainly to attempts to clean up existing fossil-fueled power facilities and mitigate the other environmental problems of dirty, inefficient power production methods.

To develop the needed technology, many years of painstaking research are necessary. At present, the only sources of government funds for research into solar applications have come from NASA, the National Science Foundation and the Air Force. NASA spends several million dollars yearly on solar-cell technology, but only on cells for limited space applications.

The newest and most innovative division of the National Science Foundation, the RANN program (Research Applied to National Needs), has begun to initiate funding in the area. Dr. Meinel's group at the University of Arizona has received a $64,400 grant to conduct an eight-month investigation of their system. But the RANN program, the brightest hope of solar scientists at the moment, has limited resources for supporting much more work in the area.

Today's leaders in the solar field remain surprisingly optimistic, however, and are full of proposals to industry and government for new agencies (such as an "energy NASA") and grand schemes for promoting this unusual product. William Cherry says: "Since solar energy can't be used as a weapon, there's no need for international secrecy. Super-facilities aren't necessary to begin developing this power source. In fact, the American public can participate in this on a do-it-yourself basis. Not many people build nuclear reactors as a hobby. Solar power can be developed at home."

The many forms of solar power may not be the sole answer to the energy crisis, but it is clear that without tremendous support, the promise of its sure, clean energy may forever be lost by a shortsighted civilization. To utilize the full potential of solar power will require years of research, development and hard work.

Solar energy's strongest supporter in the Congress, Senator Mike Gravel (D., Alaska), said in a July Senate debate on AEC appropriations: "It could be argued that the crucial gap (besides safety) between nuclear electricity and solar electricity is the multibillion dollar government subsidy for nuclear electricity. The government has spent *zero* dollars toward the development of large-scale solar electrical generating plants. . . . It makes no sense to lament an alleged conflict between energy and the environment when we have ignored our most obvious source of natural energy."

PhoneCenter

In Florida we have a telephone store where you pick out your own phones.

Then take them home and plug them in.

We're trying an experiment in a new apartment community in Hallandale, Florida. We've set up a PhoneCenter where you can browse among phones of 113 styles and colors. So you can see how they match your drapery swatches and paint chips.

Then, just pick up the phones you want and take them with you. Once home, you simply plug them into special phone jacks provided in your apartment.

Make a quick call to the PhoneCenter to verify that everything's working, and your new phone's ready to use.

Because the jacks are already in place, you can go back to the PhoneCenter for an extension phone any time you want one.

If you get an urge to redecorate, you can unplug your old phones and pick up new ones to match your new decor.

Hallandale residents have responded to the experiment very well...and we'll be trying it in other places.

The American Telephone and Telegraph Company and your local Bell Company are always looking for new ways to improve telephone service.

One way is experimenting with the convenience of a self-service PhoneCenter.

By Betty Werther

For rare birds a paradise is found in France

What with warlike men and other predators, it has not been easy for naturalist Jean Delacour to maintain his peaceable kingdom

"As a child I was always intrigued by the story of the Garden of Eden," says master-naturalist Jean Delacour, "where man, animals and plants lived in perfect peace and harmony."

For most mortals, such daydreaming is strictly for small children or Biblical scholars, but Jean Delacour has actually spent a lifetime reconstructing the place. He has succeeded so well that French author Colette called his Parc Zoologique de Clères just that—a "Paradis terrestre."

Delacour's arcadia is set in 600 acres of green Normandy countryside, complete with a 15th-century castle, ancient trees, a gently flowing stream and lawns and meadows leading to wooded hilltops. Waterfowl of 120 species waddle about in the high reeds of a small lake, tend their young and chase each other in and out of a forest of spindly flamingo legs. On the lawns sweeping down from the castle, peacocks strut, displaying their regal plumage (see cover) among giant beeches, while parrots fly freely in the branches above.

Up a grassy slope, a herd of blackbuck antelope grazes peacefully and—comic touches in this scene of nearly total beatitude—wallabies (see caption) box the air or jump up and down shaded paths, while, on a small island in the lake, a pair of white-cheeked gibbons performs a breathtaking trapeze act from the topmost branches of poplar trees.

Betty Werther lives in Paris where she works as a reporter for the International Herald Tribune.

Amid peafowl, crested cranes and a foraging wallaby, Dr. Delacour patrols his man-made Eden at Clères.

Photographs by Loomis Dean

Clères has been a center of attraction for naturalists and ornithologists ever since it was created as a private collection in 1920. They come from all over the world to observe the nearly 3,000 birds from 590 species, many rare and others elsewhere extinct, and to study the waterfowl and pheasant collections, among the richest anywhere.

But even for those who can't tell a Hawaiian nene from an Andean goose or a pitta from a broadtail, Clères, which was opened to the public in 1930 and presented by Dr. Delacour to the Paris Museum of Natural History three years ago, holds increasing appeal. An annual 150,000 to 200,000 visitors—families on outing or noisy groups of schoolchildren or scouts —arrive and are quickly caught up in the spell, somehow blending into the scheme.

On summer Sundays, when visitors may be 10,000 strong, Jean Delacour visits friends or hides in his house. On those days you are likely to come across him only in the early morning hours supervising feeding, inspecting a newborn brood of black-necked swans or, pruning shears in hand, chopping off a wilted fern or a dead twig of boxwood.

Therefore many never see the rarest specimen of all —Jean Delacour himself. A sturdily built man with gentle blue eyes, his nearly six-foot frame is now only slightly bent under the weight of 81 years of activity so intense it might easily have filled the lives of ten men. Through two great wars, over one of the most turbulent periods of human history, he has spent his life building and rebuilding what is certainly the last great private bird collection in the now virtually extinct tradition of the 19th and 20th centuries.

From hen-raising to Eden-building

At the same time he led scientific expeditions to the four corners of the Earth, hobnobbed with maharajas, kings and statesmen, helped plan or renovate some of the world's great zoos, has been a member of dozens of international scientific societies and organized some of the earliest conservation campaigns. His books, notably the four-volume *Waterfowl of the World* and the equally erudite *Pheasants of the World,* plus many hundreds of articles, stand among the authoritative writings in the field of ornithology. A noted taxonomist, he has no idea how many species he has named and classified, or how many have been named for him.

This is a man who can converse on any subject from Picasso to the Beatles or political developments in

One of a pair, a female white-cheeked gibbon of Indochina entertains on a small tree-covered island.

Lesser flamingos from Africa create their own symmetry as morning sun glows on restored chateau.

Blackbuck antelope, from a herd of 40, amble up a grassy slope past peafowl and crowned cranes.

Southeast Asia. At the age of 70, when most men are only too willing to relax in front of the fire, he had the effrontery to "regret" forced retirement from his last post as director of the Los Angeles County Museum, yet admitted it was high time because he had "so much to do and wanted to be free to travel."

"I suppose it is a handicap not to know how to waste time," he says, rooting out a weed with a small blade that is attached to his cherry-wood walkingstick. "Friends are always encouraging me to go spend three weeks in Cannes or some other quiet spot. But I'd be bored stiff."

Son of wealthy landed gentry in northern France, Jean Delacour discovered his passion for birds at age three when he raised a fluffy chick into an affectionate white-bearded hen. Serious collecting began at ten, sparked by a birthday present from his father of some abandoned aviaries on the family's 6,000-acre estate at Villers Bretonneux in Picardy. At 15, he had one of the largest collections of birds then in existence.

One of the first to observe—during the first decade of the century—that birds were decreasing alarmingly, he helped set up the French Ligue pour la Protection des Oiseux in 1910. Later, in 1922, with Gilbert Pearson of the National Audubon Society, he organized the International Committee (now Council) for Bird Protection, serving as president from 1938 to 1958.

"Despite all our efforts in limiting the feather trade, enacting and obtaining better enforcement of protective legislation, I would say there are at least ten times fewer birds around today than there were 20 years ago," he says. "You can see this with the naked eye. We ourselves have simply become too numerous. For our food supply we destroy theirs. For our housing and highways we do away with their habitats. When the world is cemented over, where are they supposed to go?"

When World War I was declared, Jean Delacour was 24. He had earned himself a doctorate in botany from the University of Lille and built his collection to 1,500 birds from 380 species, including not only rare pheasants, hummingbirds, sunbirds and birds of paradise, but many rare species like Seychelles fruit pigeons and a giant touraco.

During the war, Marshal Ferdinand Foch set up his high command in the Delacour chateau.

"I did my best not to disturb him on my visits home," says Dr. Delacour, then a young lieutenant, "but I inevitably came upon him discussing strategy with General Maxime Weygand, his chief of staff, in one of my aviaries. Foch liked to say jokingly, 'When I leave this world, I want to be reincarnated as a bird in this marvelous aviary. They look so happy here.' "

But not even Foch could save Villers Bretonneux which, with all its treasures, was completely destroyed

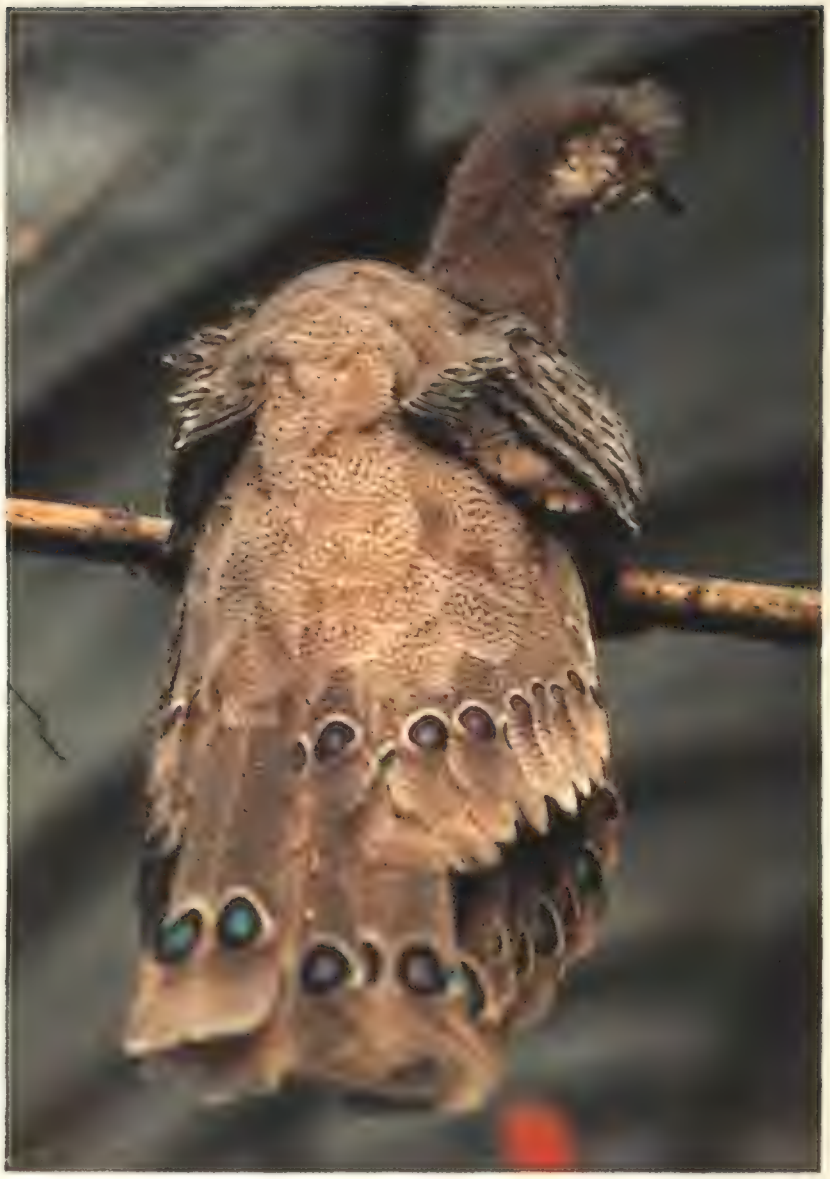
during the second Battle of the Somme. It was "a misfortune without parallel in the history of aviculture," according to *Aviculture Magazine.*

After the war Dr. Delacour set out to rebuild his collections and, through friends, found the small market town of Clères, 15 miles north of Rouen. Here, at the head of the narrow valley of the river Clairette, a delicate 13th- and 15th-century chateau in late flamboyant Gothic style stood in a 600-acre domain. Best of all, 60 acres of park and gardens with patches of woods and isolated trees seemed to provide everything he needed to begin again.

For a full year, he improved and modernized the chateau, laid out new gardens and rearranged the park. Then in the summer of 1920, he and his mother moved in, bringing with them hundreds of animals and birds. Like a latter-day Noah undertaking a second purification, he gradually eliminated destructive or unsociable species. A great number of mammals were tried and later ejected, as well as such birds as fish-eating water birds and birds of prey.

Breeding successes were numerous and the regular rearing of rare or disappearing species saved many from eventual extinction. At the advent of World War II, his collections were the best of their kind.

While he organized Clères, Dr. Delacour spent about a third of his time traveling to study and collect for



Among many species of pheasants at Clères, this Indochinese gray peacock pheasant lives in an aviary.

Free in the park is a scarlet ibis, a South American bird William Beebe described as a jet of flame.

himself and later for French, British and American museums. From 1923 to 1939, he led seven scientific expeditions to French Indochina, procuring 30,000 skins or live birds representing 1,100 species plus some 8,000 mammals from 200 species. Hundreds of these specimens were previously unknown to the scientific world.

From Central Annam, for instance, he brought back 14 live Edward's pheasants, then known to continental scientists only through four skins in the Paris Museum of Natural History. On another trip, in 1924, he electrified ornithologists everywhere by returning with a pair of dark blue pheasants never before seen in the western world. He christened these birds "imperial pheasants" and succeeded at Clères in breeding the stock from which all known existing specimens are now descended.

Painfully evoking what was then Indochina, Dr. Delacour says, "I am quite certain that with defoliation and all the other rubbish most of these extraordinary birds are now extinct. I can hardly bear to think of that beautiful but so unhappy country which was the richest for game birds of any area in the world." The end of such Edens has been a familiar theme in Delacour's life.

During his last expedition to Indochina, in 1939 when he was 49 years old, he received word that the entire interior of his chateau, with its art treasures, books and furniture, had been destroyed by fire. When Clères was the site of violent bombings in May and June 1940, a second tragedy, comparable to the loss of Villers, was complete. His collections were wiped out. France soon fell and with it all his hopes. There was nothing to do but begin another chapter in his life.

Responding to the invitation of American friends, he arrived in New York in December 1940 where Lee Crandall, curator of the Bronx Zoo, was waiting for him on the pier. Fairfield Osborn, the zoo's president,

Barnacle geese from northern Europe forage amid a leggy forest of three species of flamingos.

immediately offered Dr. Delacour, who needed little persuasion, the position of technical adviser at the New York Zoological Society.

"This was the first time in my 50 years that I had ever been paid for doing a job," says Dr. Delacour, whose fortune was, at the time, blocked in occupied France, "and it was a strange if gratifying experience. I had always been fortunate enough never to have been burdened by the necessity of making a living as so many young men are today. In fact, when I was young, it was not considered proper to work for money. Paying jobs, it was felt, should be left to those who needed them. There was nothing good or bad in this.

When fully grown, this white peacock, a strain bred only in captivity, will own an even larger tail.

An uncommonly elegant pigeon, the goura or crowned pigeon from New Guinea is common at Clères.

It was simply the way things were."

In New York he helped modernize and beautify the bird and small mammal quarters at the Bronx Zoo and worked at the American Museum of Natural History as a research associate, and also as a collaborator of the Fish and Wildlife Service of the Department of the Interior. Yet, like the indefatigable forces of nature, Delacour commuted to France to rebuild again his war-torn Eden, and in 1947 Clères was reopened.

But the Americans were not yet willing to let him go entirely. In 1952 he was made director of the department of history, science and art in the County Museum of Los Angeles, a post he executed so skillfully that in

1960, just before his retirement, the new "Jean Delacour Auditorium" there was dedicated.

Today, in the five acres of gardens at Clères, cranes, scarlet ibis and egrets move gracefully among the richly planted flower beds or between sculpted yew hedges. Sometimes they are joined by big flocks of the rarer species of geese (emperor, red-breasted, Ross's, snow, and others) on the lawns which extend over to the lower part of the park. There, on the four-acre lake, one of the world's greatest waterfowl collections lives freely along with four species of flamingos. In addition to the geese, one can observe shelldrake and tree ducks, almost all the swans, ducks and teal. Northern sea ducks (including eiders, goldeneyes, scoters, buffleheads, long-tails, harlequins) do exceptionally well in the lake's cold, clear waters.

In the early morning or late evening hours, tiny Chinese water deer and Reeve's muntjacs come to the lake to drink, casting curious glances toward two small islands, one the gibbons' domain, the other the territory of ring-tailed and red-fronted lemurs.

For birds which must be confined, pens and aviaries are carefully camouflaged throughout the park. Along a back stream, for example, divided into sections by wire-netting skillfully hidden within shrubbery, a pair of black and another of black-necked swans rear a brood or two each season. There are paddocks for larger birds—cassowaries and some pheasants like the eared tragopans and crossoptilons.

In vast aviaries behind the chateau numerous compartments, arranged by Dr. Delacour as small Italian Renaissance or Japanese gardens, house large numbers of game birds. Lady Amherst, Malay and Siamese fire-backed pheasants live at peace with doves, parakeets and such spectacular pigeons as the crown pigeon, or goura, with its lacy blue headdress. Farther on, smaller birds, giant whydahs, hummingbirds, sunbirds and touracos, flit like winged jewels among the thick foliage. Fragile tropical species—pittas, broadtails, sunbirds, gouldian finches, toucans and cocks of the rock—are housed in richly planted cages within part of the chateau.

Elsewhere, beyond public view, are breeding pens and kitchen and water gardens. In summer, incubators located in the well-equipped infirmary are stocked with giant rhea and smaller peacock eggs, but the infirmary is also used for such emergencies as when recently a pair of Australian kookaburras ferociously killed its first offspring. The Clères veterinary quickly snatched up a second egg and hatched it himself.

Of all the thousands of exotic plant and animal species Dr. Delacour has studied, he finds Man the strangest of all, and he holds out little optimism for Man's future.

"We are too highly domesticated perhaps," he says. "No 'savage' beast would allow so many of his kind to occupy his chosen territory. Even plants smother other plants out.

"I don't know quite how we can persuade Man to reduce his needs and his population without a bloody revolution, but if he doesn't he'll die violently anyway. Animals kill each other when food is lacking," says Dr. Delacour, who, practicing what he preaches, flatly decided after World War I not to have children, "since this seemed of little value in the era of turmoil and overpopulation which, even then, was already ominously threatening.

"At the rate we're going now I doubt there will be any life left on the planet in 100 years. It won't take much more pollution of air and water to finish the job. People are beginning to awaken to the dangers but it may be too late.

"Still," he adds with a smile, "we can't act as though it were." And so he will continue to do what he can, traveling in Europe and the United States, talking, writing and working to help reverse or at least delay the frightening process.

At Clères, the frightening process seems far away. Jean Delacour, always reluctant to leave his "Paradis terrestre," looks up at a recently abandoned swallow's nest over his front door and muses, "By the end of the month they will have left for Africa. The cuckoos have already gone. For all our study and conjecture, so many things, like bird migrations, remain a total mystery. Look at these silly creatures. They still have two or three good months ahead of them. Why are they in such a hurry to leave? I can't understand them."

A cock of the rock, with tropical plants from its native Brazil, is housed in a cage in the chateau.

By Joanna Eagle

The artistic odyssey of a black painter from the rural South

William H. Johnson, whose work is at the NCFA, did not find himself until he set out to 'tell the story of my people'

In William H. Johnson's *Lamentation* (right), a brown Christ has just been lowered from a brilliant purple cross. He lies limply on the ground, surrounded by the three mourning Marys. One of the women raises both arms in anguish, the others pray silently. Tilted planes and strident colors help to convey the traditional anxiety and suffering of the scene, while the figures' exaggerated gestures, their outsized hands and feet, and the agonized postures of the two thieves recall Gothic depictions of the theme, especially those of Matthias Grünewald.

This flat, patterned, grotesquely powerful style was the mature outcome of a long artistic search, the summation of a lifelong determination to paint in the face of harrowing odds, by a black artist who is only now, after his death, receiving the recognition he looked for all his life. The first major exhibition of his work opens at the Smithsonian's National Collection of Fine Arts this month (November 5) and will run through January 30.

By the time Johnson painted the *Lamentation* and similar variations on the Crucifixion theme (about 1939), he had already worked his way through a succession of styles—academic realism, impressionism, ex-

Lamentation, c. 1939. This is one of the paintings with which Johnson, in a bold switch from his early styles, achieved his most powerful expression.

W.H. Johnson

Portrait of a Youth, 1921-26. The influence of his teacher, Charles Hawthorne, is evident here.

Right: *Fruit Trees and Mountains. c.* 1936-38. A view of blossoming apple trees in Hardanger, Norway.

pressionism. But as a black artist he increasingly felt the need "to tell the story of my people" and, abruptly changing direction, used a "primitive" style to do it.

The culmination of his artistic career (a few years later he began a long descent into mental illness), they are among his finest works. Unfortunately, there was little market for them at the time, although the reviews were favorable and he showed at some of New York's foremost avant-garde galleries. But he never clicked with any one dealer who could have pushed his work, and he never attached himself to any of the styles—social realism, "American Scene" painting—that were popular at the time. He was regarded as a curiosity, and there the interest seemed to end.

William Henry Johnson's artistic and personal odyssey began in Florence, South Carolina. His mother was a black woman with, apparently, some Indian blood. His father was a "well-placed white man," according to Adelyn D. Breeskin, who organized the current exhibition and wrote the accompanying catalog, which is the most complete source of information about Johnson's life yet available.

Shortly after Johnson's birth in 1901 his mother married a black man; there were four more children. When the stepfather became crippled, Johnson's mother went to work and Willie himself, as the eldest, had to help support the family. So the boy's education was sporadic, but he quickly showed a talent for drawing and taught himself by copying cartoons and comics in the local newspaper.

Unthinkable as it might seem for a poor black boy in the rural South in the early decades of this century to decide to become an artist, that is just what Johnson decided. He worked hard, saved his money, and at 17 left for New York. There, between 1918 and 1921, he earned enough at a variety of odd jobs to support himself, send money home and start the full five-year course at the National Academy of Design.

At the Academy Johnson was assigned to Charles Hawthorne, an established academic painter and a gifted teacher, who became his good friend and cham-

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Self-portrait, 1929, is a Soutine-like work done after he had fully assimilated that painter's style.

pion. For the insecure youth of 21, it was the first of several lucky breaks. Johnson won many of the Academy's prizes during his years there, but the traveling award for study in Europe eluded him—probably because of his color. Again Hawthorne helped him, by raising personally the funds to send him abroad.

Johnson's European years were happy and productive. His seeming eclecticism—a quick progression from paintings in the Hawthorne vein (page 36) through a series of current styles—is somewhat misleading. Like most young artists he was searching for a personal style, an individual statement. And it was the work of the Russian-French expressionist, Chaim Soutine, that eventually had the most powerful influence on him. Soutine's violent, writhing style, his heavily applied paint, and above all his ability to catch the essential in a person or landscape, greatly appealed to Johnson. His landscapes begin to take on a heaving, oscillating character; everything seems in motion, even though the paint is still applied in thin, smooth layers. Later, in a self-portrait (above), the paint is thicker and the lines undulate like those of Soutine.

In 1928 Johnson went to Cagnes-sur-Mer, a town in the south of France where Soutine had painted earlier. There he met and fell in love with Holcha Krake, an accomplished Danish weaver and ceramicist who was 15 years his senior. The differences in age and race may have made them hesitant about marriage; in any event, the following year Johnson decided to return home and visit his mother.

On his way south, he won a competition in New York held by the Harmon Foundation, an organization devoted to helping black artists. It was an important contact for Johnson, as the Foundation promoted his work when he went back to Europe and salvaged it from destruction on the New York docks during his later illness.

Back in Florence, staying with his mother, he was arrested while painting the *Jacobia Hotel* (page 39), probably because the subject—which had become the town brothel—offended the local constabulary. The experience, which included time in jail, apparently cast such a shadow over his homecoming that he did not return to the South for 14 years.

Soon afterward Johnson returned to Europe and married Holcha Krake. It was an exceptionally har-

Mom and Dad, 1944, was painted during Johnson's last visit to his home in Florence, South Carolina.

monious marriage. They settled for a while in a little Danish fishing village, then went to Tunisia and finally to Norway, where they stayed three years. During these years Johnson painted with a new confidence and strength; the colors are richer and deeper, the brushwork is juicier, the figures almost burst from the canvas. His expressionism was at its height when he painted the fruit trees in Hardanger (pages 36-37).

After exhibiting in Oslo and Stockholm, the Johnsons rented a little house in the Lofoten Islands, above the Arctic Circle. There they could work around the clock, watching the sun drop below the horizon and start right back up again. Pleased with his life there, Johnson wrote to an American friend: "It certainly do [sic] seem so long ago and a long way since I was there [U.S.] but . . . things must be for the best that I have that honor to work, live, and learn in Europe before I come back to make my way in a hostile society."

But the rumblings of Hitler and the approaching war forced them to return. During a steamer trip through the fjords, the Johnsons had become friendly with David Harriton, an American artist, and his wife Helen. When they arrived in New York on Thanksgiving Day, 1938, the Harritons took them into their home and helped them settle in Greenwich Village.

These were difficult times for Johnson and his wife. The gentle, sensitive Holcha couldn't understand the alienation that met them. Johnson couldn't find work. There were other blacks painting in New York at the time—Jacob Lawrence, Romare Bearden, Charles Alston, to name a few—but they worked and visited with each other in Harlem. Bearden recalls that Johnson, still looking like a French artist with his beret, little beard and mustache, "just didn't fit into our hamburger culture." However, he was able to get on the WPA Fine Arts Project, which gave him some income, and he taught for a while at the Harlem Community Art Center. Meantime, he was painting steadily.

If Johnson had remained in Europe, he would be remembered as a minor expressionist painter. But with his avowed purpose to "paint my people" and his drastic change of style, he now conceived his most powerfully felt works, as evidenced by his *Lamentation.* Though not avowedly religious, Johnson had attended church regularly as a child, and was able to project intense feeling and dignity into his treatment of Biblical themes. Drawing on the same memories, he painted a series on rural black life, including the delightful *Going to Church* (page 39). The humor and sympathy of these paintings he carried over into a series on Negroes in the war. But as his work soared with expression and life, personal misfortunes took over. Holcha became desperately ill and died of cancer in January 1943. After that, his grief and his advancing illness dulled his creative faculties.

The last sad chapter

Johnson spent the summer of 1944 in Florence with his mother, painting portraits of family and friends like *Mom and Dad* (above). They are irresistably appealing. But the subsequent disintegration of his talent is tragic. Johnson was a victim of paresis, the result of a syphilitic infection either inherited or contracted in his youth. His mind had begun to deteriorate even before he returned to Denmark in 1946 to visit Holcha's parents. He was hospitalized in Oslo, and in the summer of 1947 he was sent back to New York and placed in a state mental hospital, where he spent the remaining 23 years of his life. His death last year passed largely unnoticed.

What we take away from the exhibition at the NCFA is not this final, sad chapter of his career, but the joy and pride Johnson felt for his fellow blacks. One of the nicer aspects of today's cultural climate is that artists such as William Johnson are now being rediscovered and are taking their rightful places in the mainstream of American art. We can also be grateful to the Harmon Foundation, which stored some 1,100 pieces of Johnson's work during his final illness. When they ceased operations in 1967, they gave all of them to the NCFA, in effect making this exhibition possible and providing an opportunity to assess the achievement of a neglected American artist.

Jacobia Hotel, 1930. In this painting Johnson uses his expressionist style on a hometown subject.

Going to Church, c. 1940-41—one of several appealing works in which Johnson recalled his rural boyhood.

Monarchs' metamorphosis and migration

Bedecking a branch like Christmas candy, the pupae of *Danaus plexippus* hatch into butterflies on a "chrysalis tree" created by Campbell Norsgaard, a nature-film producer. He persuaded this rare concentration into existence by placing a wild cherry branch in a flowerpot that stood in a dish of water. Caterpillars placed on the pot could not escape and so settled down to metamorphose (pages 42-43). A few of the 152 chrysalides were too close together so they were gently moved, their silk "buttons" re-secured. By early this month in California, swarms of thousands of butterflies will roost in single trees. East of the Rockies, fall weather apparently prompts mass migrations of monarchs in September and October from the Canadian border to the Gulf of Mexico.

A twelve-year-old's butterfly project

Inside its clear case a monarch butterfly moves. Then a tiny slit appears at the bottom of the case and slowly the butterfly emerges, very different from the creature it was two weeks earlier. It clings to its empty case as it pumps a greenish liquid through its now crumpled wings from its fat body. Soon the wings are full size and its body is thin.

My project started a month earlier when I went to a field five miles from my house where monarch butterflies were laying eggs on milkweed leaves. I took six caterpillars home and built a cage for them. I also got some leaves with no eggs on them for food.

One of the caterpillars, which was apparently sick, stopped eating and died. Soon the remaining caterpillars were ready to go into chrysalis, but they did it during the night. Determined to watch this event, I went back to the field and brought back eight more caterpillars, two of which died. Of the remaining ones, I was lucky enough to see two of them go into chrysalis: They attached themselves to a branch and then hung upside down in a J shape. They hung this way for about eight hours, then they swung down straight and their skins split. They moved around wildly until the skin fell off, exposing a different form from the caterpillar; it is the chrysalis (pupa). For about five minutes it hangs like a wiggling green blob. Then it becomes still and dries. When it is dry, beautiful golden dots appear on it. It hangs like this for about two weeks. One day the shell becomes transparent, revealing the adult butterfly. It then opens and the butterfly comes out.

I kept the butterflies for three days and trained them to feed from my finger by putting honey and water on it. I then tagged and released them.

Text and pictures by David Haden Battaglia

Six steps in the metamorphosis of a monarch: A full grown larva (1) seeks a place to weave the tiny silk "button" from which it hangs (2) by posterior hooks. The pupa develops (3), having burst and shed the larval skin. The pupal skin, now transparent (4), reveals the developing monarch. The butterfly breaks out of the cocoon (5) and clings to it while its wings expand and harden (6). The entire process takes anywhere from nine to 15 days.

2

3

5

6

Forbidding Antarctic mountains form a backdrop
for scientists investigating a melt pool.
Life-forms are scarce and often microscopic.

By Joseph M. Dukert

Antarctica: a natural laboratory—with dividends for the future

Enlightened pioneers study the continent's precarious life-forms, trying hard to preserve, not destroy, what they find

Last night began in March. Not until the fourth week in September did the bright yellow edge of the sun peek over the horizon again at the South Pole. Gold spilled across a snowfield nearly two miles deep.

The 21 Americans living, working and studying there were not the first men to watch a season's sunrise at the bottom of the globe. Still, the event this year seemed special—symbolic. We were all witnessing the dawn of Antarctica's Age of Opportunity.

Antarctica is still an empty place. Its human population is only a few hundred at this time of year, scattered across more than five million square miles. Nature's cruelty and caprice make it dangerous in any season. But it's no longer accurate to call it a frontier. Antarctica's highest mountains have been climbed, and there is no place on its surface that man cannot reach—usually in relative comfort. Work will begin this season on a shiny new station at the South Pole itself, with some buildings enclosed in an aluminum geodesic dome to discourage snowdrifts from climbing around them during the continent's dry but furious and frigid blizzards.

By treaty, rival nations have for the first time successfully set aside an enormous area for the peaceful benefit of Mankind. In this country, the civilian National Science Foundation (NSF) has been handed the purse strings and the administrative reins for our whole Antarctic program, although the United States (through NSF) will continue to use military men and equipment there in support.

In fact, peaceful military support deserves much of the credit for pushing the Antarctic timetable ahead so rapidly. Above all, credit goes to the U.S. Navy's C-130 Hercules, a noisy, rugged giant that operates steadily without strain at −55 degrees F. and can plop its broad, teflon-coated skis onto any flat stretch of snow you choose. The "Herc" lifts sharply from short fields, and it isn't temperamental. It can get along on diesel oil or truck gasoline or alcohol. Slide a house trailer aboard, via its tail ramp, and a Hercules is ready to whisk an insulated outpost to a new scientific field-site anywhere on the continent. Hercs have shuttled exchange scientists and resupplied ground parties. They often visit the Russians' Vostok Station where this country and the Soviet Union cooperate regularly in research of the upper atmosphere.

In spring, the C-130s fly out of Christchurch, New Zealand, bound for McMurdo Station, headquarters of U.S. activities situated on a penguin-inhabited volcanic island at the edge of the Ross Ice Shelf. They arrive with the first glint of sunlight—but they can visit the continent in the blind bluster of midwinter. They've done it.

Distance and climate long kept man away from Antarctica, which explains much of its value today. Its rocks, ice, fossils and the plant and animal life which evolved there represent a fresh book of natural history. It is probably the best place on earth now to establish bench marks of environmental purity.

It has many other values. Some day its mineral wealth may have to be tapped. Looking far into the future, Man might need to induce massive climatic or other changes deliberately in a sparsely populated

Joseph Dukert's book, This Is Antarctica, *comes out in its second edition this month. He is also a prize-winning film producer.*

JATO (jet-assisted take-off) exhaust darkens the frigid air as a C-130 Hercules blasts off the snow. Its smoke screen soon dissipates.

area of the globe like this for the benefit of life elsewhere. And there are perfectly good nonscientific values: It would be unfair as well as unrealistic to suggest that tourists shouldn't enjoy its marvels. They've begun to do so. Whenever we take any benefit from the Antarctic it is because we touch this territory in some way—and leave a mark.

The Great White Continent is considerably larger than the United States and Mexico combined and has more variety than most people realize. Its snow-free "oases" are warmer than the areas around them, but hardly as lush as the name suggests. Their temperatures drop to −70 degrees F. One, the size of Delaware, has rock sculptures caused by frequent dust storms.

Oases also contain freshwater ponds fed by melting ice, a lake that never freezes because it is saltier than the Great Salt Lake and one lake, perhaps 300-feet deep, whose length is normally covered by year-round, freshwater ice, but whose salty bottom waters are close to 80 degrees F. Each of these anomalies—and others like them—offers a challenge to biologists. So far, however, investigations have located little more than microscopic plankton, generally encouraged by the nourishment of bird droppings.

No freshwater fish has been discovered in Antarctica, and not a single land vertebrate is a native there today. The reptiles and mammals of the distant past are known only by their fossilized bones. The largest modern "land animal" is *Belgica antarctica*—a wingless fly only one-eighth of an inch long.

Not a single, stunted tree survives anywhere at all in Antarctica. The meager soil does support some hundreds of different, colorful lichens as well as a few tiny mushrooms among its mosses. Under some conditions, algae splash the snow with green, yellow or red. Near the tip of the Antarctic Peninsula—on the "warm side" of the Antarctic Circle—there is some low-growing grass and a single flowering herb, *Colobanthus crassifolius*, in limited amounts.

The "growing season" for ancient mosses on rock peaks near the South Pole may last only a couple of hours a day, during a few weeks of each year. Despite occasional temperature changes of 75 degrees F. within a few hours—and a range twice that great in the course of a year—these primitive plants have survived. Amazingly, they even provide shelter and food for simple animal life. Tiny insects and eight-legged mites dwell there in a remarkable microcosm, spending most of their time in hibernation.

Penguins, the trademark of the Antarctic, could not live if they were always confined to the continental landmass. Anybody who has watched them glide through water ballets with the speed of a motorboat must suspect that their clumsy waddling on solid ground is almost a prank of evolution. Being seabirds, with wings blunted into paddles, penguins drink directly from the ocean. They expel salt through glands just above their eyes.

Besides the familiar emperor and Adélie penguins that live at many points along the coast, numerous other birds either nest or visit the continent regularly. Some fly far inland, coming close to the South Pole.

Giant, prehistoric Antarctic penguins were almost as big as a man. For some reason the species has disappeared as completely as the northern hemisphere's auk. Adult emperor penguins stand somewhat over three feet but these solemn-looking big birds are relatively rare compared to the frisky 18-inch Adélie. Nevertheless, the emperor's situation may not be quite so precarious as it was once portrayed. Satellite photographs show areas of open water close to the continent even in winter. At any rate, hundreds of thousands of emperors manage to survive each season, and recent sightings indicate their colonies are growing.

Huge, snouted elephant seals inhabit islands well north of Antarctica, but some come to the mainland every year—usually at molting time. These lumbering mammals grow to more than 20 feet in length and four tons in weight. Some smaller seals are full-time Antarctic residents: the gentle-eyed Weddell and the vicious, meat-eating leopard seal, the elusive Ross' seal who sings solitary songs from atop the ice floes, and the most numerous of all, the crab-eater seal.

Most humans who visited the Antarctic during this century were respecters of nature. There were (and still are) some ignorant men, like those who have attacked the skuas with moral fervor because these predatory birds feed on the eggs and chicks of the lovable penguins. And there is the single, tragic exception of the whale hunters, who virtually eliminated the largest living creature in the history of the world—the blue whale—from Antarctic waters. But today's visitors are usually drawn by scientific curiosity; they have gone about their business with care. They are a distinct improvement over the early invaders from the north who clubbed millions of helpless seals to death or those who set up cauldrons and rendered penguins for their oil.

The comprehensive Antarctic Treaty provides free access to the entire Antarctic area. The Scientific Committee on Antarctic Research (SCAR) promotes the exchange of data which opens the whole area further. Meetings of the signatory nations have recommended conservation measures for all Antarctic expeditions.

SCAR, for example, agreed upon protective regulations to preserve 16 significant breeding and botanical sites and examples of complete ecosystems of flora and fauna. Here vehicles are banned outright and special written permission must be obtained before one can collect plant specimens. The conservation measures require a specific permit to kill or capture any native bird or mammal (except whales). The only allowed purposes are scientific, educational and cultural (zoo specimens), or to provide "indispensable food." Even then, the total number of animals which may be killed or taken in any one year is supposed to be limited to what can probably be replaced by natural reproduction in the next breeding season. The limited variety of species is a factor in granting permits too: Predators and prey are to be kept in balance.

Helicopters aren't supposed to land within a 650-foot radius of animal concentrations, and other sources of unnecessary noise are forbidden. During breeding periods of seals and birds, there's an official caution

Adélie penguins at the Cape Royds rookery show little fear of men. Charmed by the clownish seabirds, men have usually protected them.

"Bulldog" fish is one of the strange species that have adapted to Antarctic waters. No freshwater fish have ever been found.

Lichens typify sparse flora. They can dehydrate fast, thus avoiding damage from freezing, and return to life sometimes after many years.

against "persistent attention from persons on foot."

Four different inoculations are prescribed for dogs brought to the Antarctic, and there is a complete ban on live poultry to protect Antarctic birds against alien disease carriers. Animals, plants and seeds may be brought in for "domestic" as well as scientific purposes, and there have been many private experiments with indoor gardening. But they are to be kept under control so as not to upset the natural ecology or confuse future investigators.

South Georgia, Marion, Kerguelen and Macquarie Islands, as well as other subantarctic territories have already been transformed by nonnative animals. Apart from men, these include cats, rabbits, rats, sheep and even reindeer. When a Japanese expedition left its sled dogs behind at its Antarctic base in 1958, two of them managed to survive the entire following winter on the continent; so the idea of "outside" species becoming feral in Antarctica isn't preposterous. Botanists are convinced that some grasses found now on the Antarctic Peninsula were late arrivals too—brought there by the winds or by sealers or whalers during the 19th century rather than having survived the ice age which arrived some seven million years ago, as lichens probably did.

Actually, the most difficult barrier to native plant life in Antarctica is not cold but drought. Many spots along the coast and on the Antarctic Peninsula experience summertime temperatures in the high 30s, the 40s and even the 50s. Volcanic action can produce local heating. Furthermore, dark areas anywhere absorb solar heat readily, and the surface of a rock or peat bed may be quite warm even when the air temperature just above it is below zero. But rain falls only in the peninsula area, directly south of South America, and even there the total precipitation from both snow and rain averages only about 17 inches a year—roughly the same as at Flagstaff, Arizona. On much of the Polar Plateau, the fresh snow each year is the equivalent of less than three inches of water.

Lichens constitute a major part of Antarctic vegetation, however, and these are amazingly adaptable. Lab studies show that the Antarctic varieties can be frozen instantly by liquid nitrogen, yet show no ill effects after thawing. But Antarctic plants develop very slowly; photographs taken of the same lichen patch in successive seasons seem to show no growth at all.

Sunlight is a basic problem for Antarctic vegetation, not only because it vanishes for months at a time, but also because of its blinding intensity during the summer. Continuous Antarctic sunlight bores through thick sea ice, energizing great globs of the algae which coat the underside like peanut butter to such an extent that photosynthetic reaction may continue long into the dark winter. On the surface, that same overwhelming dose of light energy would kill many ordinary plants if they were exposed to it around the clock. Even Antarctic grass prefers overcast days for this reason, although it can tolerate direct sunlight as well, using it to carry on photosynthesis despite freezing temperatures. Some freshwater algae have been seen thriving inside blocks of ice—absorbing enough light through their exposed tips to produce a thin surrounding layer of life-giving liquid.

A dry valley in Antarctica is another story. No snow cover protects its surface from desiccating winds that

gust up to 100 miles an hour. Despite the glaciers which lick at its edges, most of the valley's gray and tan soil remains unwatered and lifeless. Yet even here Antarctic researchers have located a few vital signs. Digging down to surprisingly moist permafrost less than a foot beneath the arid surface, they have found ancient microplants and bacteria. Some look as if they had been "freeze-dried"; some are capable of being restored to life. A number of the simple organisms there and elsewhere in Antarctica are chemosynthetic. They need no light at all, getting energy to grow from a purely chemical cycle of oxidation and reduction.

The National Aeronautics and Space Administration (NASA) has been extremely interested in these discoveries, because such dry valleys are analogous to what we think the surface of Mars is like (see SMITHSONIAN, October 1971). NASA investigators have used the Antarctic areas to evaluate the effectiveness of automatic equipment that eventually will be used to search for extraterrestrial life.

Dr. Roy E. Cameron, of the California Institute of Technology's Jet Propulsion Laboratory, has suggested an even more imaginative extension of these particular Antarctic biological studies. During annual Antarctic expeditions, he has collected tons of different soil samples—some of which produce a fertilizing effect on microorganisms grown in more favorable circumstances and some of which prove toxic. Limited tests with "moon soil" from the Apollo flights have shown similar results, but lunar samples are too scarce for extensive growth experiments. When Man builds permanent bases on the moon, Dr. Cameron reasons, he ought to use its local resources as much as possible to extend the supplies he carries with him. There may be no need to haul fertilizer or potting soil along if Earthbound agronomists can develop enough clues from Antarctic studies to help Man pick safe and potentially productive "farm sites" on the moon.

Antarctic oases need protection

Unfortunately, for all their scientific interest the "oases" of Antarctica are not yet protected. Until three years ago, some of the field parties that visited the Taylor and Wright Valleys near McMurdo took no special steps to avoid contaminating them. Since then, however, New Zealand and American teams have cleaned up the litter of previous encampments, and unnecessary visits are discouraged. New Zealand's new Vanda Station (along the shore of the puzzling hot-and-cold Lake Vanda) is situated so that its drainage will not affect the unique lake in Wright Valley, and a small incinerator takes care of most station trash. Human waste, food containers and certain other rubbish is hauled out of the valley by helicopter.

The New Zealanders, who also operate Scott Base in the immediate vicinity of McMurdo, removed tons of snow from inside the Antarctic huts which explorers Scott and Shackleton had occupied during the first part of this century. Now, preserved by Antarctica's dry cold, these are historic shrines. Their original furnishings and even the food left behind by the explorers are still quite usable, but safeguarded by international agreements pursuant to the terms of the Antarctic Treaty.

At McMurdo, the summer population of scientists, support personnel and other visitors generally hovers around 1,000. The community, after 16 years, still has no sewage-treatment facilities or closed incinerators. The components of both have finally been delivered and work on them should now proceed, but it's difficult to justify a system of priorities under which the new two-story administration building for McMurdo Station apparently had to come first. Up to now, some trash is burned on an open dump while a clutter of other debris simply goes tumbling down a man-made "yellow glacier" to pile up on the sea ice until the next thaw can "dispose of it." Yet Antarctic vegetation is peculiarly susceptible to airborne pollution caused

Dr. Igor Zotikov, a Soviet exchange scientist, and Dr. A. P. Crary of the National Science Foundation meet on common ground: the South Pole.

Tourists—a new Antarctic breed—set out
for some sightseeing from McMurdo Post Office.
So far they have treated the land carefully.

by open burning, and divers report that beer cans, tractor parts and other assorted junk paves the bottom of McMurdo Sound near the station, physically smothering many of the smaller sponges that used to grow there. For the really enormous sponge specimens—some of them now taller than a man and over 100 years old—the new pollution-control systems are coming none too soon.

New diesel generators to be installed by the U.S. Naval Support Force in Antarctica will use catalytic afterburners to remove the great bulk of exhaust pollutants. And McMurdo would be a far dirtier place today if it had not been getting most of its energy supply from a smokeless nuclear reactor plant which was installed almost a decade ago. In keeping with the treaty, the retired fuel elements from the reactor are shipped back to the United States periodically—along with other radioactive liquids and solids. On-site examinations by a pair of diving biologists also indicated recently that the thermal effects of McMurdo's nuclear-powered desalination plant involve "no noticeable ecological consequences whatever" to date.

Yet the Antarctic continent is still affected by worldwide pollution. Fallout from faraway nuclear explosions reached it promptly, although with less effect than in the North Polar regions. So did the residues of long-lived chemical pesticides, which obviously have never been used in Antarctica. In part, DDT and other chlorinated hydrocarbons have been delivered by members of the food chain which range far to the north during part of each year. Another avenue must be the atmosphere, however, because DDT has been present for years in snow that falls on the interior of Antarctica—far from the coast and more than 10,000 feet above sea level. Breakdown products of DDT are feared to be affecting the calcium balance of some birds like Wilson's petrel that visit the Antarctic, although local concentrations are probably still too low to have much effect on the penguins.

Recently, investigators have found suspicious traces of lead in the Antarctic; and they are on the lookout for mercury, cadmium and other toxic heavy metals which could be products of far-off industrializations.

We are getting close to the crunch in Antarctic conservation. Some countries are taking a new interest in the old sealing grounds. And an Antarctic native with a mounting price on its head is the plentiful, protein-rich krill called *Euphausia superba*. It's a colorful crustacean, a couple of inches long at maturity, whose dense swarms may cover acres of ocean area. Individual whales used to gobble down *Euphausia* by the ton, but as the monster mammals thinned out the krill flourished. The Soviet Union has studied the krill supply since 1967, and now Russians fish for it commercially, making edible products from it. The U.S. National Marine Fishery Service made a limited survey in 1970 of how to catch these shrimp, and Japanese fishermen indicate they will begin using krill in food. Economist Neal Potter, of Resources for the Future, Inc., has mentioned commercial possibilities for both krill meal (as a food for broiler chickens) and krill flakes (which are alleged to be "reasonably palatable" as food for human beings).

An adventuresome chef on one French Antarctic expedition despaired of ever preparing a palatable dish of krill, which is mostly shell, but some penguins eat it. So do seals and squid. So do the birds who fly over the Antarctic Ocean and some of the fish who swim there. In sum, krill probably *should* be cropped; but we'd better do it with some care—both as to the size and the locale of the catch.

Tourists: so far so good

There are some who act as if opening the Antarctic to tourists represents an even greater peril than the emerging krill industry. Stung by this attitude, spokesmen for Lindblad Travel, Inc., the only American group now sponsoring regular tours to Antarctica, have reacted sharply. Their pique is justified in part, for travelers aboard the *Lindblad Explorer* currently consist largely of history buffs and naturalists who regard the Antarctic with reverence. Such tourists wouldn't dream of trampling a lichen. But Lars-Eric Lindblad didn't invent Antarctic tourism; he only refined it. And his careful customers may not monopolize all future voyages.

More than 20 tourist excursions have headed for Antarctica since the Argentines and Chileans pioneered them in the late fifties. By the end of the seventies, the number of commercial visitors annually will probably run to thousands instead of hundreds. Without careful briefing, those well-intentioned tourists could cause trouble.

In the 1970s the people who go to the Antarctic are going to see a new scientific approach. Some of the basic collecting and recording and categorizing must go on, of course. Having determined that seals can dive more than a quarter of a mile below the surface, and appear to navigate by sonar while holding their breath, biologists have started to study diving habits of less spectacular species. Surprisingly, it appears that a bird like the blue-eyed cormorant may go down a couple of hundred feet into the ocean in search of tidbits. Some fauna have been neglected almost completely because they are still so difficult to collect. These include the large fishes and perhaps the phenomenally large squid which inhabit the deepest parts of the Antarctic Ocean.

Biochemists are analyzing the protein "antifreeze" that keeps fish and certain insects from turning to ice. Social behaviorists are studying the way penguins protect themselves from their natural enemies, the skuas and the leopard seals and the killer whales.

In the current International Antarctic Glaciological Project, begun this year, scientists from the United States, the United Kingdom, the Soviet Union, France and Australia are collaborating in a broad scrutiny of a vast ice cap area, covering most of East Antarctica. Interpretation of results over at least ten years could tell us definitely whether normal climate cycles and the effects of global industrialization are combining to shrink or expand the ice cap.

Measured in dollars and compared to other fields, our activity in the Antarctic is a small national investment—under $35 million a year, including all logistical support. In any terms, the dividends thus far and the ones promised in the future are great.

The new day is upon us. Antarctica holds dazzling opportunities. Unless we are apathetic or unthinking, night need never fall again.

Small boat from National Science Foundation's research vessel *Hero* probes mist-veiled thermal pool in the Deception Island volcano.

By Isaac Asimov

In dancing flames a Greek saw the basis of the universe

In his final article on the Greek elements, Dr. Asimov looks into Heraclitus' fire, finding the universal conservation of energy

In the sixth century B.C. a Greek thinker known as Heraclitus (c. 540-475 B.C.) lived in Ephesus on what is now the Aegean coast of Turkey. He was known to the later Greeks as the "weeping philosopher" because of his pessimistic view of life. To him nothing was eternal, nothing stable; all was evanescent, everything changed, everything that came into being was eventually destroyed.

To Heraclitus, fire was the symbol of change and destruction, and it was fire (or some ideal version of fire) which he therefore accepted as the basic substance of the universe. Only through fire could the impermanence of the universe be explained. For the only thing that was unchanging, according to Heraclitus, was change, and therefore only leaping, ever-changing fire was eternal and basic.

During the next two centuries, Heraclitus' concept was tamed. Fire came to be accepted as merely one of four elements that made up the Earth and its works. (See "The Greeks' four universal elements—and then some," SMITHSONIAN, April 1971).

In his scheme of the organization of the universe, Aristotle (384-322 B.C.) placed fire in the highest regions appertaining to the Earth, lying above the air. Ordinarily invisible, it appeared briefly as lightning when the air was rent by the fury of storms. Fire, when formed in the lower regions, tended to burst upward in an effort to reach its natural place on high. Thus fire shot up out of volcanoes, and even the small flames set by man strove upward.

Through ancient and medieval times fire, as a substance, resisted investigation. But it was used everywhere, in forming glass from sand, pottery from clay, metal from ores, and invariably it produced light and heat. Indeed, it was often used by man for no purpose other than to turn night at least a little into day and winter at least a little into summer.

Light existed only as long as the fire lived; when the fire died, the light was gone. Heat persisted. A Dutch physician, Hermann Boerhaave (1668-1738), first made this distinction between light and heat. After Boerhaave's time, scientists began to consider heat as the fundamental aspect of fire. Light and flame, fire's most visible and striking attributes, seemed merely a temporary accompaniment of heat as it rushed out and mixed with air.

The first to investigate heat in the modern sense was the Scottish chemist Joseph Black (1728-1799). He knew that if a kettle of water were placed over a fire, its temperature started to rise. If, however, the kettle contained a mixture of ice and water, the temperature did *not* rise when it was placed over a fire. Instead the ice melted, gradually. Only after the ice had all melted, did the temperature rise. Similarly, after water reached a boil, more and more of the water boiled away, but the temperature rose no higher no matter how fiercely the fire beneath roared.

Black tried to explain this in terms of a kind of heat-fluid which gradually filled the ice, melting it (or, at higher temperatures, filled the water, boiling it). It was not until the ice was saturated with the heat-fluid so that it had all melted that there was finally heat-fluid available to begin heating the water. It was only after all of the ice had melted that the tempera-

Isaac Asimov, something of an elemental force himself, recently published his 117th book.

"I'm earth!"
"I'm air!"
"I'm water!"
"And I'm fire!"

Drawing by H. Martin;
© 1971 The New Yorker Magazine, Inc.

In cartoonist Henry Martin's celebration of the four elements and Isaac Asimov's articles thereon, a pre-Greek vaudeville team (perhaps the Cro-Magnons) dances a soft-shoe finale.

ture of the water began to climb to the boiling point.

The French chemist Antoine Laurent Lavoisier (1743-1794) accepted Black's thinking on the heat-fluid and, in 1789, when Lavoisier published the first modern textbook of chemistry, he included heat among his list of elements. He named the weightless heat-fluid "caloric," from the Latin word for heat.

The heat-as-fluid theory conveniently explained several other observations. For instance, substances almost invariably expand when they are heated, and it is easy to suppose that caloric takes up room. Why not?

On the whole, the theory of heat-as-fluid satisfied the chemists, but it left the physicists with a gap in *their* theories. In 1668, for instance, the English mathematician John Wallis (1616-1703) dealt with the "momentum" of moving bodies, that is with the product of their mass and velocity. He showed that he could successfully analyze the results of collisions between moving bodies by supposing that momentum could be transferred from one body to another but could be neither created nor destroyed. This is called "the law of conservation of momentum." It is the first-

discovered member of a group of conservation laws which, taken all together, set the ground rules, so to speak, for all the changes that go on in the universe.

Another type of conservation can be demonstrated by a ball thrown in the air. It moves more and more slowly as it rises, until at some point in midair, it comes to a halt. But what we now call the "energy" of a body (its capacity to do work) depends in part on its motion. A moving ball will break a window or knock over a tenpin, but a stationary ball will do neither even if in contact with the window or tenpin. Furthermore, the more rapidly the ball is moving the more spectacularly it produces its results on collision. In the case of the ball rising into the air the energy of motion ("kinetic energy") gradually diminishes and, when it is at a halt, the kinetic energy is zero.

But, high in the air, the ball has a certain energy by virtue of its position. If it were held there it could do nothing, but once it is free to move, it falls at once and begins to gain kinetic energy. The higher in the air it is, the more kinetic energy it gains by the time it strikes the ground. The energy content by virtue of position is called "potential energy." It would seem, then, that as the ball rises in the air kinetic energy gradually turns to potential energy, and as it falls again the potential energy once again turns back to kinetic energy.

It is easy to show that the potential energy at the moment when the ball is motionless in the air is equal to the kinetic energy at the precise moment the ball begins to rise upward and also to the kinetic energy at the precise moment that the ball completes its fall downward.

As it rises and falls, the ball's kinetic energy is converted to potential energy and then back to kinetic energy without loss. What's more, at every point in its rise and fall, the kinetic energy *plus* the potential energy (together they are called "mechanical energy") remain constant.

The effect is shown more elegantly by a pendulum, where the bob has its maximum kinetic energy at the bottom of the swing. If it is then heading leftward, it will rise more slowly, coming to a halt at a point where all the kinetic energy is turned to potential energy. Then it drops back to the bottom faster and faster, swings to the right, comes to a halt where all the kinetic energy is turned to potential energy—and so on, over and over and over.

The notion of the conservation of mechanical energy gradually emerged in the course of the late 17th century, though most of the actual terminology (and even the word "energy" itself) didn't come until the 19th century.

One of the difficulties with the law of conservation of mechanical energy was that it was imperfect. A bouncing ball reaches a lower height with each bounce and finally comes to rest. More or less slowly, the mechanical energy disappears and, in the end, an object has neither energy of motion nor energy of position. A pendulum's swing very slowly contracts and it finally comes to rest. The villain in the case is friction —friction with the ground, friction with the air—friction with anything the moving object touches.

Could it be that the mechanical energy is somehow transferred to the ground or air or whatever? At first thought, this doesn't seem likely. After all, the matter accounting for the friction does not visibly gain either kinetic energy or potential energy. It neither moves nor changes position as a result of friction.

What is heat—motion or fluid?

But is it necessary for the object supplying the friction to move as a whole or to change position as a whole? Suppose that apparently solid matter (or liquid or gaseous) were actually made up of tiny particles far too small to be seen, and suppose that these tiny particles moved every which way in a kind of blur that was not visible to the unaided eye.

After all, objects could be *warmed* by friction. Perhaps, the invisible motion of the invisible particles of matter was what we called heat: the faster the motion, the greater the heat. The loss of mechanical energy in visibly moving objects might then result from the transfer of that energy to the tiny particles of matter which would gain a corresponding amount of mechanical energy. Another way of putting it is that friction converts mechanical energy into heat.

As early as about 1700, the English philosopher John Locke (1632-1704) was suggesting the idea of heat-as-motion (kinetic theory) which was eventually opposed to heat-as-fluid (caloric theory). If heat were

accepted as a form of motion, then the law of conservation of mechanical energy might be extended to include heat, and it might then become less imperfect—or not imperfect at all.

The chief trouble with the suggestion was the notion of tiny particles too small to see, engaged in motions too subtle to detect. Scientists, generally, were not ready to accept so apparently mystical a concept, and the law of conservation of mechanical energy remained as it was—imperfect—and the real nature of heat remained mysterious.

Yet before the end of the 18th century, some strong blows were struck in favor of the kinetic theory of heat. The first of these involved one of the more colorful characters in the history of science, Benjamin Thompson (1753-1814), who was born in Massachusetts. During the Revolutionary War he was a tory serving the British authorities as a spy. Naturally, when the British left Boston, Thompson found it safer to leave with them. He never returned to the United States.

In 1783 he left Great Britain as well and eventually entered the service of the Elector of Bavaria who was pleased enough with the American's services to give him a title of nobility. Thompson chose to be titled after the town near which he had owned some land and became Count Rumford.

One of Rumford's tasks, in 1798, was to supervise the boring of cannon for the Bavarian army. The way this was done was to have a horse work a treadmill, the turning of which supplied the power that kept a borer turning. The borer forced its way into a solid block of brass, slowly forming a cylindrical hole of the required size.

As the borer worked, brass shavings were gouged out and these, together with the block itself, grew so hot that the metal had to be constantly cooled with water. Rumford couldn't help but wonder where all the heat had come from. According to the caloric theory, the breaking up of the solid brass into shavings released some of the caloric content of the brass into the air, where it was more evident. But to Rumford this seemed nonsense. After all, how much caloric could be liberated in such a way? Certainly not more than the metal contained in the first place. Yet he calculated that if all the caloric released in the process of boring were put back into the metal, the entire block would melt.

He tried something else. He began with a partly excavated cannon and then began operations with a borer so blunt that it could not gouge out any further brass. Now the brass was not breaking up and no caloric ought to be released. Yet heat developed in even greater quantities than when a sharp borer was used.

Rumford pointed out that this heat was produced without fire, without light, without chemical combustion. It came just out of motion, out of the turning of the borer and the treadmill, out of the motion of the horse. He maintained that heat was a form of motion and that heat would be formed endlessly as long as horse, treadmill and borer moved.

Then in 1799, the young English chemist Humphrey Davy (1778-1829) worked out some interesting demonstrations with friction. He used clockwork to make a metal wheel turn against a metal plate. Though he kept the entire system below freezing, enough heat was developed to melt the wax with which he had coated the plate.

In the same series of experiments, he rubbed two pieces of ice together mechanically and, though the temperature was again kept below freezing, the ice melted. The point was clear. If there were insufficient caloric in the entire system to raise the temperature above freezing, how could the release of only some of that insufficient quantity produce enough heat to melt ice and wax? Again the conclusion seemed to be

Molten steel "teems" from a ladle: Since ancient times men have used fire but for centuries they did not distinguish between its heat and its light.

that there was no such thing as caloric and that heat was kinetic in nature, a form of motion.

Then in 1803, less than five years after the experiments of Rumford and Davy, the English chemist John Dalton (1766-1844) began to advance his atomic theory, and it might seem that the calorists had received their deathblow. After all, Dalton's reasoning in favor of atoms was so strong that many chemists began to accept it at once: Here was the refutation of the strongest point against the kinetic theory of heat. Matter *was* composed of particles so tiny as to be invisible, and surely these particles might be invisibly in motion.

As it happened, though, the early atomists, including Dalton, were calorists. According to the atomic theory, atoms were in contact in liquids and solids; but in gases, the atoms had to be far apart from one another. Only by so much wide separation could it be explained why gases were so much lighter than were equal volumes of liquids and solids, and why gases could so easily be compressed, whereas liquids and solids could not be. But what kept the atoms of gases so far apart? Since gases are formed when liquids are heated, Dalton suggested that gases had gained so much caloric that all the atoms were surrounded by it. They were atomic islands embedded in weightless caloric seas.

Thus the caloric theory survived the coming of the atom, and the competing kinetic theory of heat made no headway. But it was not forgotten; stubbornly, some physicists kept returning to it.

It was clear that if, indeed, a certain amount of mechanical energy (whether kinetic, potential or a combination) could be turned into heat, then, if energy was to be conserved, the mechanical energy had to be turned into a *fixed* amount of heat.

How much energy meant how much heat? What, in other words, was the "mechanical equivalent of heat?"

Rumford had made a rough estimate to the effect that (using modern units) 5.55 joules of work was equivalent to one calorie of heat. In 1842, a German physicist, Julius Robert Mayer (1814-1878)—he was born in the year Rumford died—offered a new figure on the basis of a single experiment in which a horse-powered device stirred paper pulp in a caldron. This was 3.90 joules per calorie, which is much closer than Rumford's value to that which is now accepted.

Mayer also advanced a startling insight. He claimed that energy was perfectly conserved *if all its manifestations were included*. One had to take into account not only mechanical energy and heat, but light as well and electrical energy, magnetic energy and so on. Even the energy of living things must be included. Energy must change its form in a dozen different ways but when, within a particular "closed system" (one which did not lose energy to, or gain energy from, the outside world), all the energy was added up, the sum remained constant always, no matter what changes took place within the system.

Mayer's enunciation of the "law of conservation of of energy" went utterly unnoticed. It was too daring an idea, too far in advance of experimental data. Even as Mayer worked, however, the insufficiency of data was being corrected.

An English physicist, James Prescott Joule (1818-1889), who was unaware of Mayer's work, was tackling the problem of the mechanical equivalent of heat. For years he worked to determine this value in a score of different ways, using every form of energy he could handle. He heated water and mercury by churning them with paddles. He passed water through small holes to heat it by friction. He expanded and contracted gases. He used electricity to heat water. Even on his honeymoon, he made use of a special thermometer to take the temperature at the top and the bottom of a waterfall.

An amateur lawmaker

In the end he found that a given amount of energy *of whatever form* always yielded the same amount of heat, and he set the mechanical equivalent of heat at 4.18 joules per calorie. (He didn't use the unit "joule," of course. The joule was invented later, set equal to ten million ergs, an older unit, and named in his honor.)

In 1847, Joule, an amateur, had a chance to present his results before a scientific gathering. The audience was unsympathetic, and sat in stony silence until a young Scot, William Thomson (1824-1907), who was in later life to become Lord Kelvin, rose to ask a question. Thomson's shrewd questioning and Joule's clear answers began a lifelong friendship between the two,

and their enthusiasm at this time infected the audience. Joule was taken seriously at last.

In that same year, a young German physiologist, Hermann von Helmholtz (1821-1894), presented a paper that maintained the conservation of energy in precisely the same terms as Mayer had done five years before (though at the time Helmholtz had not heard of Mayer's work any more than Joule had).

For a time Helmholtz, too, could not get his paper published, but under the hammer strokes of Joule's experimental labors, more and more physicists were rallying to the kinetic theory of heat, so the notion of a law of conservation of *all* energy had to be accepted. The concept of caloric tottered to its fall.

Nowadays, the credit for the law of conservation of energy, usually considered the greatest and most fundamental of all the laws of nature, is shared among Mayer, Joule and Helmholtz. Two others might be added, though. Ahead of all of them was a French physicist, Nicolas Léonard Sadi Carnot (1796-1832), whose studies of the steam-engine cycle in 1824 showed the relationship between mechanical energy and heat. Carnot, however, died prematurely of cholera, and his single publication went unnoticed until the 1840s. There was also a Danish physicist, Ludwig August Colding (1815-1888), who in the 1840s independently advanced notions of a mechanical equivalent of heat and the conservation of energy.

By the 1860s, the kinetic theory was completely established on the basis of random motions of atoms and molecules, and caloric was killed forever. We can see now how great an insight was the Greek choice of fire as one of the elements of the universe. And if we consider fire as the most obvious and dramatic form of energy available to ancient man, we can appreciate the insight better.

It is of energy in all its forms (and even matter is but a form of energy) that the universe is constructed. What's more, energy is eternal, it can neither be created nor destroyed, and every change in the universe from the explosion of a galaxy to the motion of an electron is an aspect of energy-change.

So it follows that the old Greek sage, Heraclitus, was quite right after all. In a subtle way fire is the fundamental element, the basic, unchanging factor in a changing universe.

Crackling down from Aristotle's "highest region," lightning rends the skies over Tampa, Florida.

Rustic arch topped by a Gothic spire topped by Mercury memorializes Jack-the-Treacle-Eater who ran like the wind despite his sticky diet.

Photographs by Terence Spencer

By David Lampe

The 'follies' of Britain– odd structures for odd reasons

Jaded by affluence? How about a ready-made ruin in your garden . . . a grotto with a live hermit . . . a tower to upstage your neighbor?

Six miles south of Yeovil in Somerset, a conical-roofed tower balances on a horseshoe-shaped rough stone arch. Legend connects this strange structure with one Jack-the-Treacle-Eater. A bronze figure atop this tower, although surely the god Mercury, is said to be Jack himself. He was a messenger boy who regularly ran from Barwick Park, where the monument stands, to London, about 115 miles. He supposedly sustained himself on molasses. Jack-the-Treacle-Eater's monument was built in the 1820s when George Messiter, master of Barwick Park, put it up along with three other crude, inexplicably shaped boundary markers.

Jack-the-Treacle-Eater is little remembered outside his native county. His monument is but one of thousands which Britons over the centuries have created. They are known today as "architectural follies." These things also exist in other countries, but nowhere else do they seem quite so absurd, and certainly nowhere else are they so numerous.

In Great Britain any structure that was erected without a discernible purpose may be classified a folly. So also may any building built for a purpose that has been forgotten. Britain also has a few ex-follies—such as the three-story brick tower left unfinished in the tiny Berkshire village of Woolstone for almost 100 years. Recently roofed, it is now a somewhat gaunt house.

One day in the early 1800s an English squire named John Fuller boasted to dining companions that he could see seven church steeples from his manor house lawn. Six, one of his friends corrected, not seven. What, Fuller boomed, about the new steeple in the village of Dallington? Surely that spire, his friend insisted, lay behind Dallington Hill. Squire Fuller wagered that it did not, but the next day he noticed to his dismay that it did.

John Fuller—known even in his lifetime as "Mad Jack"—was immensely wealthy, and Dallington Hill was on his land, so he could have had its summit removed, cartload by cartload, to win his bet. Instead, no doubt chuckling to himself, he told his estate stonemasons to improve his view. When their work was completed, he invited his friends onto his lawn and asked them to look toward the southwest. In the distance they saw what did indeed appear to be the tip of the Dallington church steeple.

Nobody knows how Mad Jack's bet was settled, for what his friends saw was not Dallington steeple, but a 40-foot masonry cone on the peak of Dallington Hill, so large that for a time a family lived inside it.

Mad Jack Fuller built other absurdities—two glorious domed buildings, a long and unnecessarily high wall, a 65-foot obelisk and a "hermit tower," although no hermit ever lived in it. Twenty-four years before he died, Mad Jack completed his ultimate masterpiece—his own mausoleum. Some Sussex people believe that the 300-pound squire had himself interred upright inside it, fully clothed, top-hatted, seated at a lavishly laid table, grasping a bottle of claret. Appropriately, this tomb, which overshadows all the others around it and which like the rest of Mad Jack Fuller's inane masonry did at least provide work in Sussex when times were hard, is in the shape of a pyramid.

Not one folly adorns David Lampe's Herefordshire farm. He writes for British and American magazines, and his latest book, The Last Ditch, *was about Hitler's aborted invasion of Britain.*

"Mad Jack" Fuller's simulated church spire atop Dallington Hill won him a bet from his friends, and later housed a farm family.

Broadway Tower, on Fish Hill, Worcestershire, was built by Lady Coventry about 1800, supposedly to mark England's most central beacon.

Among Britain's architectural follies are the mail boxes in the Worcestershire villages of Rous Lench and Radford, disguised in the 1890s as summerhouses by a wealthy local doctor of divinity, W. K. W. Chaffy. He also built an Italian campanile in his own back yard to remind the world, it is said, that more than 200 years before in that very garden Richard Baxter had written the book "Saints' Everlasting Rest."

Some follies have been flimsy structures of cloth, plaster and thin wooden lathing. Most of these have disappeared. Some stupendous ones have crashed spectacularly under their own weight. Others—a great many others—are likely to stand forever, or at least until someone with neither sense of history nor sense of humor decides to hack them down.

British architectural follies can be put into three categories: pure follies which serve no purpose at all and never were intended to; fancies, which are functional or semifunctional, follies only in appearance; grottoes, which are—grottoes. Students of British architecture do not always agree which constructions deserve to be described as follies; those who live inside them tend not to admit that they are follies at all. Widow Alice Hollington, for example, who for 38 years has made her home in Broadway Tower (sometimes known as "Lady Coventry's Whim") on Fish Hill, Worcestershire, above the tourist town of Broadway, sees nothing odd about a house that has four stories but just one room on each floor, nor about a house that looks like the keep of a Gothic castle, with three cylindrical, crenellated towers. "A folly? Never! Lady Coventry built the tower in 1797 for a perfectly good reason. It marks the site of the most central signal beacon in all England."

Two steeples settled an argument

Britain's oldest known folly is an ordinary 14th-century church with two steeples standing in the small Lancashire town of Ormskirk. Local people believe that it was built by two sisters. One sister wanted a spire, the other a square tower—and so . . .

Another very old folly overlooks the River Orwell in Suffolk, a brick building which has just six rooms, each the same size, one atop the other. Why, in the mid-16th century was Freston Tower built? Views from it are not spectacular, and it is wrongly placed for a lighthouse. Some people guess that the tower was part of a larger house, but nobody remembers traces of such a building. Anyway, people in 16th-century Suffolk did not build six-story houses, much less six-story towers.

Early in the 18th century, poet Alexander Pope started a trend. To get from his house near the Thames at Twickenham to his garden, he had a passageway dug under the road. Poetically, he called his tunnel a

Norman church seen from Tattingstone Place, East Suffolk, is just a false front (below) to disguise three humble workmen's cottages.

"grotto," and people who heard of it were impressed.

A back-to-naturalness man who railed against garden topiary—sculptured bushes and hedges—Pope nevertheless was all for bricks-and-mortar follies. On the Gloucestershire estate of a wealthy friend and patron, Lord Bathurst, the poet built a pseudo-rustic summerhouse at the junction of seven avenues of trees. He spoke of it as "my bower" and it soon became known by its present name, "Pope's Seat." Together the poet and the Lord designed a pseudo-Gothic sham ruin. They called it "Alfred's Hall" and put it on the precise spot where in the ninth century, dressed as a minstrel, King Alfred is supposed to have spied on invading Danes. This folly, today genuinely crumbling, inspired others on estates all over Britain. Every gentleman of fashion had to have his own private picturesque ruin, genuine or spurious, and sometimes they went to ridiculous lengths to produce them. In Herefordshire Lord Bateman demolished a perfectly serviceable village church built in Norman times just to re-erect its chancel arch and two of its doorways on a hilltop. To placate his villagers, Bateman built them a new rococo-Gothic house of worship.

Britain, hooked on landscape gardening, kept planners like Lancelot "Capability" Brown ("This garden," he would say, "has capabilities") working overtime. They swept away or planted whole forests. They had buildings offensive to the patrician eye demolished or screened from view by follies they called "eye-catchers." They also made some essential buildings visually more tolerable by heavily disguising them. And so what appears from the lawns of Tattingstone Place, in East Suffolk, to be an ancient church is merely a row of three humble workmen's cottages, the "steeple" a three-sided, open-top masonry box.

In this great age of landscape improvement, top-heavy towers sprouted mushroomlike from the roofs of timid little gatehouses. Farmhouses grew battlemented wings to become—only in appearance—miniature castles. And the sort of tumbledown castles that until then were seen only on the horizon, began appearing everywhere, even in deep valleys. Most "sham

"Hadrian's Arch" crowns a Midlands hill at the Anson family's stately home. It bears the busts of George Anson, Royal Navy hero, and his wife.

castles" (as they are called today) were inaccurately detailed and badly built, and most were out of scale. Many of the other eye-catchers, however, were meticulous copies of real buildings. Admiral George Anson, for example, must have once sent his captains ashore in China and Greece with notebooks and tape measures—because the Anson family seat, Shugborough Hall, Staffordshire, has, among other garden decorations, a Chinese summerhouse, a Doric temple, a Grecian "Tower of the Winds," a full-sized replica of Hadrian's Arch surmounted with busts of the admiral and his wife and a "Lanthorn of Demosthenes." Nobody is sure why the Ansons also built a very messy little Gothic sham ruin, an elaborate monument to an unidentified shepherd, or an equally imposing one to a cat. This folly started the British craze for monuments to pets. One wealthy huntsman erected a tall obelisk on the precise spot where his horse carried him safely across a chalk pit instead of into it.

Elaborate garden follies became fashionable in the 18th century. A gentleman in Dorking, Surrey, attempted to recreate the Valley of the Shadow of Death, complete with skeletons and coffins, and another folly gardener, in Hafod, Wales, set up his own Garden of Eden. There were many labyrinths in gardens and at least 100 homemade Stonehenges, some full-scale, others only knee-high. A genuine prehistoric ring of stones discovered on the Channel Island of Jersey was transported and set up at great expense in a private garden in Henley-on-Thames.

No folly garden features were quite as bizarre, however, as the caves, usually artificial, often built above ground, that were known as "hermits' grottoes." Some of these were decorated inside with shells or fossils, and many were constructed of a man-made material called Coade stone, or merely made of canvas on wooden frameworks. Some false caves were hung with genuine stalactites from real caverns, shot down with guns.

Many grottoes were actually inhabited by what were said to be real hermits—old men who received stipends simply to sit around meditating. At least one English squire created a formal retirement pension scheme for his garden hermit. And those fashion-conscious members of the British gentry who could not afford hermits sometimes made do by placing in their grottoes effigy hermits. Grottoes with paid hermits eventually became so commonplace that slum children in England 150 years ago would heap junk on street corners and put begging signs on them: "Please remember the grotto."

In the late 18th century the craze for folly dwellings began, and it continued into the 19th century. Brand new Gothic castles appeared, often with Grecian or rococo interiors. Pseudo-Indian country mansions were built. Sezincote's oriental dome, gardens and tennis changing room, perched almost on top of its unoriental grotto, inspired the Prince Regent to build his oriental folly, the Royal Pavilion at Brighton.

Occasionally folly homes were built for a more explicit reason. A plaque in charming, morose Clytha Castle, on a Monmouthshire hill, explains that a

Shipped stone by stone from the Channel Islands,
this genuine prehistoric ring of boulders
was carefully reassembled in a Thames-side garden.

widower put it there as a distraction during his bereavement. And in Cumberland the pro-American Eleventh Duke of Norfolk celebrated American independence with a folly castle named "Bunker's Hill."

During the 19th century a few follies were built to hide the spreading railroads. There are Gothic, Grecian and even Egyptian tunnel entrances. One at Clayton, Sussex, on the main London-to-Brighton track, appears to be a miniature castle with two octagonal towers, but is actually a cottage that has been occupied continuously for the last 130 years. When steam trains ran, soot filtered upward blackening wallpaper and net curtains. Fast trains rattled windows and caused chinaware to crash off shelves. Even today's electric trains screaming beneath cannot drive out the occupants, for the housing shortage in Britain is critical.

At the same time that the cozy little follies were being built, Britain's least-known and yet unsurpassed folly was under construction. William John Cavendish Bentinck Scott, Fifth Duke of Portland, psychopathically shy, decided to hide from the world. He shut himself in a corner of his manor house, Welbeck Abbey in Nottinghamshire, as a recluse, having messages left in a box at the door. His servants were told that if they recognized him out-of-doors they were to look the other way.

Finally the duke took to tunneling. He employed all the jobless miners in his corner of the Sherwood Forest to tunnel from his manor house to the town of Worksop, a mile and a half away. This tunnel, which still exists, was made wide and high enough for two horse-drawn coaches to pass. To get to London the duke would be taken through his tunnel to Worksop where his coach would be shuttered and driven to the railroad station. There it was lifted onto a flatcar.

The duke spent the rest of his life tunneling from his house to all the outbuildings on his estate. He also dug a whole series of rooms. Although he never again mixed with people, the duke carved out of the earth one of Britain's largest private ballrooms. His subterranean dining hall was reached from the pantry by a maze of sloping corridors laid with narrow-gauge railroad tracks. Food prepared above ground was lowered on a dumbwaiter, then put on a tiny railroad car and allowed to coast into the dining room where His Grace served himself. This railroad even has sidings.

By the time the duke died in 1879 the enormity of his follies suggested the Great Pyramid—only underground. Skylights illuminated the tunnels and subterranean chambers. Today the estate is a training center for army cadets.

The 15th and 16th Earls of Shrewsbury built grottoes, a "Chinese Gothic" temple, an imitation Stonehenge and a Swiss-style chalet in which a blind Welsh harpist lived, emerging to strum soft music when the

earls and their friends walked the paths, admiring such features as the tall pagoda from which a 70-foot spout of water jetted. In a pasture, to achieve a truly rustic effect, the 16th Earl placed a flock of sheep—cast of concrete. This great folly, Alton Towers, is today a public amusement park. As well as most of the original features, it now has a sea lion pond, a merry-go-round and an overhead cable car.

On a hill above the Scottish port of Oban, when the 1890s' gayness was dimmed by massive unemployment, a banker, John Stuart McCaig, put men to work on a replica of Rome's Colosseum. Its detailing is bad, its arches are pointed rather than rounded, and it is not oval, like the original, but round. And since, again unlike the original, it has no seating inside, this spectacular eye-catcher is a pure folly.

Although squat, McCaig's Folly is usually referred to as a "tower," probably because throughout Britain's

McCaig's Folly, a replica of the Colosseum dwarfing the roofs of Oban, Scotland, is seatless and purposeless—a pure folly.

The Brighton train roars between medieval castle towers at Clayton, Sussex. Tunnel-keeper's cottage nestles between them, above the track.

folly-building history the best follies, from Freston on, have been towers. Perhaps the most famous was built by William Beckford, son of a wealthy lord mayor of London, who for no explicable reason decided that he must live in a gigantic Gothic ruin. He commissioned Fonthill Abbey, and it was built, unfortunately, so badly that twice its tower collapsed spectacularly.

Britons have built folly towers for every imaginable reason and for no good reason at all. At Abberley, Worcestershire, a commoner named Jones built a Gothic clock tower in 1883, according to one source so that he could look down on a patrician neighbor. And Hadlow Tower, in Kent, is believed to have been added to the mansion of a local squire to remind his runaway wife that he was still in the neighborhood.

Other folly towers were built for less sensible reasons. When the Parson family learned that Bredon Hill, Worcestershire, which they owned, was only 961 feet high, they decided to build a lookout tower on it that would make it 1,000 feet high. Due to a miscalculation, however, they did not achieve their goal. And on Box Hill, Surrey, a cylindrical tower is said to mark the grave of Major Peter Labellière. He had himself inserted head downward—so that on Judgment Day, when the Lord turns the world upside down, he will be the one person able to stand on his own two feet.

Folly-building in Britain tapered off after the 19th century, although some impressive follies have been built in living memory. In Wales there is a modern hotel built to resemble an Italian resort village. It was a fashionable hideaway in the days when Noel Coward stayed long enough to write *Blithe Spirit*. And it still is.

One last outrageous folly

Few outright follies have been built in Britain since World War I, but the last one is at least in the grand tradition. In 1935 Lord Berners bought a hilltop outside the Berkshire town of Faringdon simply to keep its trees from being cut down. Pestered by busybodies who kept telling him that the land would be more valuable without the trees, he announced that he intended building a tower on it. He was joking, but when he learned that a protest was being organized, he decided to go ahead.

Local people persuaded the Ministry of Health to hold a public hearing at which, among other opponents to the tower, a retired admiral testified. He stated that the proposed structure would spoil his view of the countryside. The chairman reminded him that from the admiral's estate he would need a telescope to see the tower. The admiral insisted that he *always* viewed the countryside through a telescope.

Building permission finally granted, Lord Berners commissioned the present Duke of Wellington to design a 140-foot Gothic tower. The duke, however, drew up plans for a plain brick column and ordered building to be begun. By the time Lord Berners saw it, it was over 100 feet high. Appalled, he insisted that the rest of the way up it must be Gothic.

The somber structure has recently become a vandals' playground, and its entrance is bricked shut. If the trees around it are ever cut, the people who did not want it built may for the first time be able to see it. Probably nothing like it will ever be built in Britain again. No one would have the nerve.

A Chinese pagoda spouts a 70-foot fountain at North Staffordshire's Alton Towers, whose noble owners tried everything once.

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Dust rises as riders and wagons wind westward in a William H. Jackson painting. This train headed for Oregon, not California, but faced the same adventures and hardships and triumphs.

By Sonia Levitin

First heroic trek across the wild land to California

Eight years before the Gold Rush, a party of would-be Californians blazed an unforgettable trail to the Golden West

It was a magnificent plan. Five hundred people had formed the Western Emigration Society to make the first overland journey to California. But when John Bidwell, the young Missouri schoolmaster, arrived at the rendezvous, nobody else was there.

What had happened to all the willing pioneers who had agreed to meet at Sapling Grove on May 9, 1841? They had spent the winter organizing and dreaming of Mexican-held California as an earthly paradise. Where were the horses, the wagons, the men?

Bidwell waited. Presently a lone horseman rode into town. George Henshaw, old and ailing, was bound for California to regain his health. In short order Bidwell talked him out of his horse and swapped it for a team of oxen. Now there were two who waited.

Gradually others came straggling into camp, an unlikely assortment of characters. There were the Kelseys, rugged Kentuckians—Andrew and Isaac, Samuel

with his wife and five children, Ben with his 17-year-old wife Nancy who carried their infant in her arms. Merchants like Josiah Belden sought prosperity. A few pleasure-seekers came for adventure. One particularly pleasant fellow was avoiding the law.

They faced a preposterous undertaking. Small wonder that most of the original 500 had come to their senses sometime between winter and spring. There was no route to California, simply because no emigrants had ever made the trip. Hostile Indians roamed the plains. Nobody knew whether to expect desert wastes, impenetrable forests or impassable mountains.

But these doubts were secondary to the dream of "a land of perennial spring and boundless fertility," where thousands of wild cattle and horses were free for the taking, where oranges grew on trees, where "fever and ague" were nonexistent. From Dr. John Marsh in California they had heard that "the difficulty of coming here is imaginary." Marsh advised his friends in Missouri to head "ever west" until they found a river flowing through a gap in the Sierras straight to the San Joaquin Valley. ("It is pronounced *Wakeen,*" Marsh admonished.) If the going got rough they could simply make canoes and float into California! A fraudulent old map confirmed this notion. The emigrants were unperturbed by the knowledge that Marsh had never taken the route himself.

When 68 people had gathered they paused to organize. John Bartleson was elected captain—a clear case of blackmail. Bartleson possessed Marsh's letter and the old map, the only clues to a route, and he had brought eight riflemen. Unless he were made captain, Bartleson declared, neither he nor his men would go. Bidwell was elected secretary of the group. He had promised to keep a daily log of the journey for later publication in a Missouri newspaper. President of the company was Talbot Green, described as "a young man of evident culture and very pleasing address whose most important possession seemed to be a quantity of lead that he was taking with him." A latecomer brought news that a group of missionaries bound for Oregon was approaching, guided by Thomas ("Broken Hand") Fitzpatrick, an experienced mountaineer. The California emigrants seized upon this stroke of luck and joined forces with the missionaries, led by Father Pierre-Jean De Smet. They would travel together along the Oregon Trail to Soda Springs —where the missionaries would strike north for Fort Hall and the emigrants would continue west.

To follow the Oregon Trail meant to improvise a path along the great rivers of Kansas, Nebraska and Wyoming. Only a few trappers had ventured through this wilderness, and some of them had died in the attempt. That Fitzpatrick consented to lead inexperienced wagoneers with slow-moving cattle and crying babies is a wonder.

Fitzpatrick kept his own pace; the emigrants could take it or be left behind. Valiantly they followed, learning from Fitzpatrick how to survive. He taught them where to camp, how to place their wagons in a hollow square with the cattle picketed outside. Straying oxen were a constant annoyance. The beasts were

John Bidwell, Missouri schoolteacher

prone to wander and precious morning hours were often lost retrieving them. Night patrol was sternly and repeatedly enforced.

Life on the trail meant daily compromises. If an extra barrel of flour stole space, vital tools or blankets had to be sacrificed. Wagons themselves were a luxury—the first American mobile homes. The oxen that pulled them were slow and stupid, but in extremity they could be eaten. Mules were surefooted but surly, as everyone agreed. "It was my mule who taught me to cuss," wrote Nick Dawson, who had left home at 19 to spend six years seeing the world.

On the fifth day out, Jimmy-John caught up with the caravan. Bidwell called him "one of the bravest men I have ever known; game to try anything." To him the trek was like an extended hunting and fishing trip. In his diary he kept a tally of his catch.

With Jimmy-John came Joseph Chiles, a widower of 31 who left his four little children with friends to indulge his "love for adventure." Chiles, who was to make the overland trip five times in all, wrote in flowing terms of Nancy Kelsey.

Another of the Kelsey clan, the Widow Gray, was married en route to a one-eyed trapper, Richard

Mrs. Lloyd Levitin of Moraga, California, writes for magazines. Her autobiographical book, Journey to America, *has won two juvenile honors.*

Phelan. She had known him only a month—romance on the trail blossomed quickly. The first marriage occurred less than three weeks out. Isaac Kelsey married a Miss Williams. The ceremony was performed by the Reverend Joseph Williams (no relation), who had astounded everyone by riding into camp one day, entirely alone and unarmed.

An itinerant Methodist preacher, Williams was 63 and the father of 16 children. Undaunted by age or family ties—perhaps because of the latter—he decided to go West and preach. But on the lonely trail he was seized with fear of Indians. He dismounted, knelt in prayer and regained his courage. Upon meeting the company, he hailed the Catholic Father De Smet with the cry, *"Unus dominus, una fides!"*

Williams relished a good theological debate and engaged De Smet continually as they rode. Williams' favorite theme was tolerance, but he found it difficult to tolerate the travelers, whom he condemned as "a wicked band, Deists and universalists," and worst of all, "backsliding Methodists." He noted that one Sunday night violin music was heard, and scribbled in his diary, "Woe to the wicked!" He proposed Sabbath prayers, but only ten came. One woman asked him to sing (entertainment was scarce), then to pray (remembering his calling).

Bidwell called Father De Smet "one of the saintliest men I have ever known, of great kindness under all circumstances, always beaming with good humor."

Twenty miles of hell a day

And circumstances were trying. Wagons tumbled down over cliffs and broke into pieces. Stones, gullies and fallen timbers blocked the way. Then there was the shock of seeing spear-wielding Indians along the Kansas River and the Platte. Fitzpatrick assured them that these were the friendly Pawnee; even so, the Indian tribes waged fierce war with each other, and a white "friend" could be caught in the middle.

The weather was capricious, changing suddenly from broiling heat to drenching rain, harsh wind and hailstones "larger than a turkey's egg." Once the wagons were threatened by a waterspout, "towering like a huge column to support the arch of the sky."

Fitzpatrick kept them going at an exhausting pace—as much as 20 miles a day, paid for in fatigue and flaring tempers. The emigrants considered parting company but clung to their guide.

Dawson, out hunting alone one day, was startled at the sound of an Indian war whoop. He ran to mount his mule, whereupon the perverse creature whirled around and headed straight toward the Indians. In a moment, Dawson was surrounded by 40 Cheyenne braves who, with thrusting spears, made him dismount. "They seized my gun and knife, stripped me of my outer clothing and, taking my mule, left me."

Dawson rushed back into camp, too shaken to realize that he was leading the Indians behind him. He spread the alarm. The pioneers rushed for their firearms. Dawson had already leveled the sights of a borrowed rifle at an approaching Indian, when Fitzpatrick restrained them all and rode out to meet the Cheyenne. He concluded that they were merely prankish and engaged them in a powwow that lasted most of the night. Fitzpatrick, Dawson and the Indians sat in a circle, and for each of Dawson's belongings something was bartered and a peace pipe smoked all around. "Fitzpatrick's patience gave out before all was got back," wrote Dawson, "and declaring that I ought to be satisfied to have got off with my life, he refused to intercede further." From that night on Nick was forever called "Cheyenne" Dawson.

The Platte Valley (Nebraska) was buffalo country. Jimmy-John enjoyed the sport of killing huge buffalo bulls, one of them taking 20 shots before he fell. Bidwell deplored the waste and wrote angrily: "Behold with indignation the shameful and outrageous prodi-

Pierre-Jean De Smet, missionary priest

gality of the whites, who slaughter thousands merely for their robes and leave the meat . . . to be eaten by wolves and vultures."

The appearance of buffalo herds brought a new danger—stampede. Night after night the emigrants stayed awake shooting rifles and building fires to divert the beasts. "We could hear them thundering all night long," Bidwell reported. "The ground fairly trembled." The dust and filth left by the animals made water impossible to drink. Oxen tended to mingle with the running herds and were never recovered. In mid-June, Bidwell described the sculpture of Scotts

Nick Dawson, adventure-seeker

Bluff, "beautifully grand and picturesque [they] counterfeited the lofty spires of towering edifices and spacious domes of cities." At Independence Rock they paused to inscribe their names—and start another tradition of the trail.

Throughout July they followed the Sweetwater and Green Rivers of Wyoming and came upon a mountain trading post. Prices were outrageous: sugar and pepper, $1 a cup; flour, 50 cents a cup; a blanket, $15; tobacco, $2 a pound (chewers were not beyond backtracking several miles to search for a lost plug). It had been explicitly agreed that no liquor was to be brought along. But Bartleson had stowed a large supply of alcohol in his wagon, which he sold to a party of trappers. The unfortunate men were later found murdered by Indians who coveted the whiskey.

On August 11 the trail ended at Soda Springs in what is now Idaho, the cutoff for Fort Hall and Oregon. Now the emigrants were faced with whether to risk the unknown trail to California or proceed north with the missionaries and Fitzpatrick. Families split. The two men with their new brides decided to play it safe and head for Oregon. Sam Kelsey with his wife and five children also chose to stay with the guide. Of the original 68, only 32 men and Nancy Kelsey resolved to push on to California.

Bartleson sent two men to Fort Hall to try to recruit a guide. The wagons would move slowly westward, directed by the old map that pictured a river flowing out of Salt Lake straight to the Pacific.

The party continued over hills, down ravines, seeking water, finding none. Then their wagons sank deep into the salt plains. In the shimmering heat strange mirages began to form, and they pushed themselves beyond endurance toward every false oasis. The animals could scarcely eat the salt-encrusted grass. By the time their scouts from Fort Hall found them, the overlanders were hopelessly wandering in circles.

The scouts brought grim news: No guide was available. But they had been given good advice: "Don't go too far north where even experienced trappers have perished in the steep canyons. Don't go too far south lest you encounter the arid desert and salt plains without grass or water."

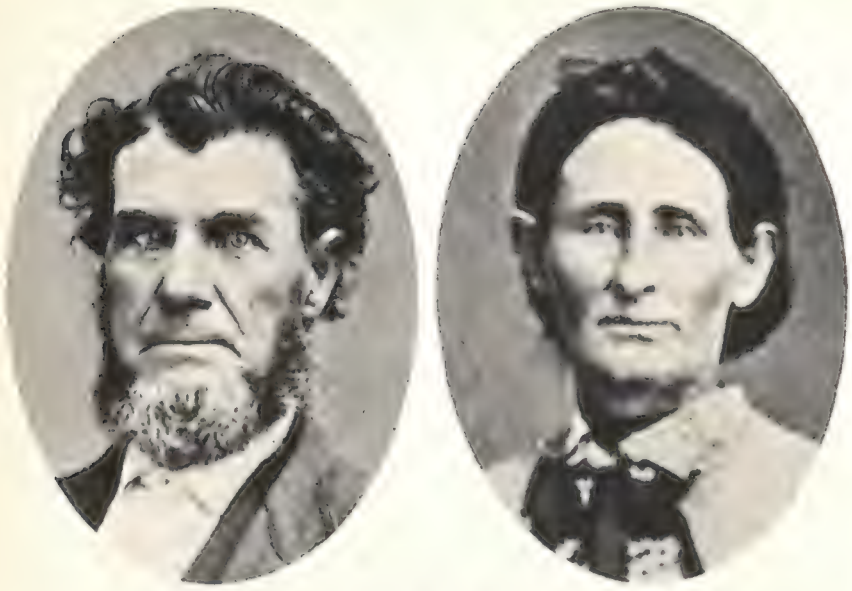
They crossed the Nevada desert dotted with sagebrush. Mountains and valleys were obscured by the dense smoke of Indian fires. Often they traveled until midnight, finding neither water, food nor fuel. Too tired even to unpack their animals, they slept in their tracks. They came upon an occasional lake, always searching for the river that would guide them into California. At last they found the Marys River (now the Humboldt) named on the map, and Dawson recalled the shock. "The river seemed to be dwindling instead of receiving big tributaries to swell its flood and guide us into the plains of California . . . and alas, what meant those big mountains ahead with no opening through them?"

They had reached the Sierra Nevada range. The animals, overworked from the start and now fatigued from lack of food, had to be rested for a whole week before attempting a crossing. And one night in early September the pioneers found ice in their water buckets. They needed no guide to tell them that the Sierras had to be crossed before the first snow.

Food was gone. From passing Indians they acquired a bit of venison, a few berries, a sweet substance called "honeydew." It tasted delicious—until they discovered that its main ingredient was excreted by insects. Nick Dawson gladly traded a butcher knife for a handful of pine nuts, and deliberated with himself whether to eat them all at once or "dribble them out." At last they had to begin killing their oxen for food.

In mid-September they realized that they must

Dr. John Marsh, California rancher



Kelseys of Kentucky: Ben and Nancy

abandon their wagons, pack the animals and proceed on foot. This too was to become a grim tradition of the trail. Later the road to California became littered with cooking pots, bedsteads and tools, all sacrificed when sheer survival became the only necessity.

Nancy Kelsey was to miss her wagon most. She had to walk, leading the horse and carrying the baby, or to ride with the child before her on the saddle. Ben Kelsey and the other men spent hours trying to pack the oxen. In minutes the packs fell apart, scattering possessions everywhere. Bartleson threatened to leave the slow-moving oxen behind, but necessity made him patient. The oxen had become the "commissary."

They trudged on up the mountains, systematically slaughtering their oxen, but there was never enough food. Near the summit of the Sierras they halted in complete despair. Scouts warned that the mountains were impassable. They voted to continue.

When nearly all the oxen had been butchered, Bartleson made a proposition. He and his men would take most of the meat from the ox just killed; later he would pay back the others from one of his own animals. No sooner had Bartleson received the meat than he mounted and rode off, calling back that he and his men were going to California. "If you can keep up, all right, otherwise you may go to hell!"

Nine days later Bartleson and his men came limping back, sick from eating spoiled fish and unable to find a trail. All was forgiven when Bartleson moaned that if he ever got back to Missouri he'd gladly eat out of the trough with his dogs. But he abandoned the company twice again after that, leaving Bidwell and Ben Kelsey to pick out a trail as best they could.

Of the Sierra crossing Nancy Kelsey recalled that one old man (probably Henshaw) gave out and "we had to threaten to shoot him before he would attempt to descend the mountains." Animals dropped from exhaustion. It became a practice for the emigrants to wait at the bottom of a precipice, and when an animal fell over, it was knocked on the head. The meat was immediately stripped and eaten nearly raw and dripping with blood.

Descending the mountains, they came upon a steep gorge and sent Bidwell and Jimmy-John ahead to see whether it was passable. A gunshot would signal the others to follow. Bidwell decided they couldn't get through, but Jimmy-John disagreed, fired a shot and was off. Bidwell hurried back to tell the others not to come, but they had already started, continuing down into the gorge until the animals were worn out. That night they gathered grass from the canyon cliffs to keep the animals alive; the men brought water in their boots and poured it down the animals' throats. On October 22, they killed the last ox.

They were now in the territory of the Horse Thief Indians, so named for their liking for horse meat. One of them lured the travelers into a trap, waiting for them to die so that he could eat their horses. Grove Cook killed him instantly with a rifle ball. Cook's rifle also routed several other Indians caught spying while the travelers buried their remaining valuables in the mountains. Talbot Green finally cached his lead, which was getting heavier by the hour.

Their loads could not be lightened further—extra clothing had been discarded, mules and horses had been consumed. But still more mountains loomed ahead. Andrew Kelsey and a Mr. Jones were sent ahead to scout, while the others remained in the valley, too weak to continue. "I was deliberating," wrote Dawson, "whether I should not just remain where I was and die."

They had already endured the worst, but they didn't know it. The valley was the San Joaquin in California. That mountain ahead was Mount Diablo, and at its base was John Marsh's ranch.

Game at last!

Suddenly their luck changed. Rifleman Charles Hopper killed a deer! For two days they rested, killing and eating 13 deer and antelope. Then they moved slowly westward, thinking their scouts were dead. To their astonishment a white man came riding toward them—Jones. He had come to fetch them, having found an Indian who uttered the word, "Marsh!" Kelsey, too, was safe at the Marsh Ranch. Two days later, November 4, 1841, the journey ended.

John Bidwell became one of California's wealthiest citizens, owner of the large Chico Ranch which became the nucleus of that town. Bidwell was three times a candidate (though unsuccessful) for governor, a prohibitionist candidate for President in 1892, and he remained prominent as a statesman and philan-

thropist until his death in 1900. Josiah Belden became the first mayor of San Jose. "Cheyenne" Dawson returned to Arkansas to marry one of his former pupils and brought her out West. He lived to be 83.

Talbot Green returned to the mountains for his lead, and became one of San Francisco's most trusted businessmen. In 1851, still well liked and now married, he ran for mayor. At a dance a woman recognized him and cried out, "I know you—you're Paul Geddes from Philadelphia!" All was revealed. He had abandoned his wife and children in Philadelphia after embezzling bullion—the "lead" he had carried so far. He returned East and was never heard from again. But San Francisco's Green Street is named for him.

Joseph Chiles became a respected leader of wagon trains. Both he and Hopper, the hunter, lived out their days in California as honored pioneers.

Young Andrew Kelsey became a property owner, holding the local Indians in virtual slavery until they rebelled and killed him in 1849. Ben and Nancy, too, had a disastrous encounter with Indians. During a Comanche attack, while the Kelseys were traveling toward Mexico, their 12-year-old daughter was attacked by Indians and scalped. "We found her the next day," said Nancy, "partially deranged. She died from her ordeal six years later." Baby Ann, who was carried across the plains, is never mentioned again; perhaps she died in early childhood. The Kelseys never prospered, and although a creek and a town in California bear their name, few Californians even know of Nancy Kelsey, first woman to arrive overland.

Of the 33 emigrants who accomplished the trek, seven kept journals or later wrote their memoirs. Each one understated every hardship and minimized his own role in the venture. It is, perhaps, typical of the hero never fully to understand his own heroism.

Jackson's painting shows wagoneers reaching Salt Lake Valley, Utah. Whether here or at the San Joaquin, men stared dazedly at their Promised Land.

Book reviews

Americans at Home
Harold L. Peterson
(Scribner's, $14.95)

The author of this book, chief curator of the National Park Service, presents more than 200 paintings, drawings, prints and photographs of American interiors between the years 1659 and 1878 as depicted by contemporary eyewitnesses. He has knowledgeably and carefully annotated the illustrations with references to what they do, or sometimes do not, prove about changing fashions in domestic interiors, floor coverings, draperies, wall treatments, furniture arrangements and various other matters of concern to anyone with more than a passing interest in the surroundings of daily life in America during those years.

The evidence ranges from the best-kept rooms of pretentious establishments to the careless and spare disarray of frontier shacks and makeshift shanties; the illustrations vary from formal canvases by distinguished artists like Thomas Sully, S. F. B. Morse and Eastman Johnson to fairly crude woodcuts and casual sketches by unidentifiable limners of modest talents. (Some of the least sophisticated renderings provide the most unexpected and welcome information.)

On the whole, the author's illustrations constitute a discriminating and generous selection. For the most part he has carefully avoided needless repetition of significant material and has also unearthed or brought into his focus little-known subjects that add appreciably to his demonstration. Certainly no collection that is at once so diverse and comprehensive in the way of evidence has thus far been brought between two covers of a book.

It takes a trained and critical eye to diagnose these pictures as meticulously as Mr. Peterson has done. He calls attention to the presence of cuspidors in elegant settings and the disposition and nature of wastebaskets, as well as to the stylistic refinements of period furniture. He takes us from the kitchen through the bathroom to the parlor and the bedroom —and into wayside taverns and military barracks—without overlooking a clue that will improve our understanding of just how people disposed, put up with, or did without the paraphernalia of daily life a century or more ago.

As Mr. Peterson suggests, only a courageous curator would attempt to duplicate the untidy clutter of incongruous elements that so often characterizes the indisputable evidence the author here puts on record.

The book would have benefited from at least some colorplates.

—*Marshall B. Davidson*
Author of *American Heritage History of Notable American Homes*

The Lion in the North
John Prebble
(Coward, McCann & Geoghegan, $15)

As its title suggests and the author admits, this is a history of Scotland written by an Englishman. When an Englishman looks at Scotland, he looks north. Had the book been written by a Scot, it would have been called *The Lion in Us,* or *Heroic Deeds of My Ancestors,* or some such. I don't mean to suggest that an Englishman shouldn't be allowed to write a history of Scotland, but it's good to know at the start who is conducting this sojourn through the Lowlands, the Highlands and the Hebrides.

Mr. Prebble is a most deft and skillful writer, and he has crammed a thousand years of Scottish history into a mere 315 pages without giving the impression of undue haste or even unseemly crowding. Moreover, he quite obviously has deeply researched the field, for he has managed to touch most of the climactic events in Scotland's turbulent past. The book is filled with the battles, murders, plots, rebellions, piracies, cattle-poachings and the like that make up so much of Scottish history. He has given us the name of the man who betrayed Sir William Wallace to the English and the identity of the clan, the Campbells of Argyll (bad cess to them), who perpetrated the Massacre of Glencoe. It is good to have these facts on record and readily available.

Yet there is this matter of Mr. Prebble's being English. It's a question of perspective, and what is history if it's not perspective? Personally, I wasn't really offended by the author's penchant for quoting long-forgotten English visitors on the tendency of Scottish lassies not to bathe too often. Nor did I particularly mind his frequent comments on the Scottish lairds' habit of siring what he delicately calls "natural" sons. We've had worse things said about us by Englishmen. In fact, we've said worse things about ourselves. Yet this historian has neglected matters of the greatest moment in Scottish history. He barely mentions, for example, that it was an English king, William III, who gave the order to massacre the MacDonalds of Glencoe, even if he did find a Scottish clan, the Campbells (see above) as ready tools for the ugly work. He neglects to state that when Bonnie Prince Charlie gallantly fought for his Scottish birthright against the English usurper at Culloden, the chief of the Clan Campbell (the Duke of Argyll) commanded the right flank of the *English* army.

Sir Henry Raeburn's painting of Alasdair Ranaldson MacDonell of Glengarry epitomizes the Highland romanticism.

Mr. Prebble also omits the nickname won by the Duke of Cumberland, the English king's son, for the vengeance he wreaked on the Scots after Culloden: He was called "The Butcher."

There are other more disturbing matters in this book. For one, the author has taken the remarkable view that Scots are one people, made up way back from a mélange of Gaels, Picts, Norsemen, Saxons and whatnot. To an Englishman, I guess, all Scots look alike. Mr. Prebble doesn't seem to understand that the ancient enmity between Highlanders and Lowlanders (*i.e.,* Sassenachs) stems from the fact that they are different peoples. As a result, the author treats Campbells, Lamonts, Huntleys and other Lowlanders almost as though they were peers of the MacDonalds, MacLeans, MacLeods and, if I may say so, the MacNeils.

For all that, I haven't yet come to the most serious flaws. Here is a book, most cleverly written and most handsomely printed, that pretends to be a history of Scotland and yet it does not deal with three of the four great contributions Scotland made to Mankind. I concede that Mr. Prebble does show proper attention and deference to the immortal bard, Robert Burns, but you can search this book from beginning to end without ever finding the game of *golf*. As well write a book about England and not speak of crickets, or whatever it is they play there.

Worse, there is no mention of Scotch. Is it conceivable? Mr. Prebble does not even admit that the Scots gave the world the word "whisky" (from the Gaelic *uisge beatha:* water of life) not to mention the stuff itself. And finally the author has paid no homage at all to the elemental glory of the bagpipes. St. Andrew, be my stay! The great music, the pibroch! The music best for love or war, for a frolic or a lament. That Englishman sure knows how to hurt a laddie!

—*Neil MacNeil*
Time Washington correspondent,
Historian Laureate of Clan MacNeil

Who Owns America?
Walter J. Hickel
(Prentice-Hall, $6.95)

The first third of Walter Hickel's book is so bad that it's embarrassing. The rest is so good that it's fully worth the red faces that it will cause in powerful places.

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The reader—having weathered Hickel's childhood on a rented farm in dust-bowl Kansas; having seen him arrive in Alaska with the proverbial 37 cents and turn it into millions; having watched him fight for statehood, then wrest the governorship from the Democrats against mighty odds; having yawned through his Senate investigation following his appointment as Secretary of the Interior—having survived all that, or skipped it, can settle down to a stimulating commentary by a remarkable man on the workings of 20th-century democracy in the United States.

This is not, as it might have been in the hands of a lesser man, a backbiting exposé of the ways of government; it is a forward-looking exposé of the ways of government. Hickel uses his 22-month odyssey at Interior as a springboard for unconventional ideas about the wise husbandry of this country for the maximum long-term benefit of its 200 million owners.

Hickel's preoccupation seems always with developing the human in Man, putting people as directly in charge of their own destinies as possible. This he envisages to be the role of government. He attaches as much importance to Man's inner and spiritual environment as to his outward and visible one. As Interior Secretary, this got him into trouble first with the "buck-power" men of industry—particularly the oil companies—and then with the "vote-power" men of politics.

I was fascinated by his account of his 1969 mission to Micronesia, the Trust Territory of the Western Pacific for which the Interior Department has administrative responsibility. Hickel believed we had not lived up to our mandate there. In Saipan, the capital, he promised to speed up the process of self-government and said that land would not be taken from Micronesians for any government purpose (*i.e.*, military bases) without full consultation and compensation.

The visit was a great success. All the people had was their land and, as Hickel writes, they naturally wanted to own it. Having himself lived in a territory much of his life, Hickel sympathized. However, back at a meeting in Washington, Hickel found Henry Kissinger, assistant to the President for national security affairs, insisting that the United States had the right to condemn what Micronesian land we wished, to build what bases and other facilities we wished.

"What right did we have to invoke eminent domain on the Micronesians?" argued Hickel. All they had asked for was a voice in government decisions. To which, Hickel says, Kissinger retorted, "There are only 90,000 people out there. Who gives a damn?"

There are intriguing chapters on the struggle within the Department's Bureau of Indian Affairs to come up with Indian leadership; on the Alaskan Arctic and subarctic, where about half of all our public land lies along with two-thirds of all our continental shelf; on the Alaska oil pipeline, whales, the SST and, of course, on the famous "Faithfully Yours, Wally" letter to the President.

All this comes laced with Hickel homilies ("It takes one man to do something right; it takes 100 men to make something appear right"), tongue-in-cheek Hickel humor and the occasional Hickel sourdough expletive. And enough rousing oratory on freedom, heart power and hope to fill inaugurals through 1980.

—Henry Pelham Burn
New York writer with U.N. experience

Microbes and Morals
Theodor Rosebury
(Viking, $7.95)

A year ago, bacteriologist Theodor Rosebury nearly walked off with the National Book Award in the field of science for his study of our cleanliness fetish, *Life on Man*. Raymond Phineas Stearns won that prize with *Science in the British Colonies of America*. Rosebury now has produced a sequel to his earlier work that concentrates on our puritanical attitudes toward two of our top reportable infectious diseases—gonorrhea and syphilis.

Dr. Rosebury's writing style is enviable, considering his somewhat technical sub-

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ject matter. Yet *Microbes and Morals* will not stir belly laughs for it is an angry book, a *j'accuse* directed at doctors, government and private citizens alike for attempting to sweep the "social diseases" under the rug instead of attacking them openly and unabashedly.

The author was led to write this study by the marked increase in VD in the United States. Surprisingly, it is no more marked among the young than among other age groups. Blending history, bacteriology and sociology, he has concluded that no vaccine and no amount of funds will effectively control the spread of VD until basic attitudes change. "We can hardly hope for success . . . until we have divorced the VD problem from the traces of original sin which still cling to our approach to it."

Throughout history, some of the best and worst figures suffered from VD: Boswell, Keats, Mussolini, Ivan the Terrible, Casanova. The ostensible embarrassment, however, resulting from the nature of the disease's transmission (through sexual contact, not via toilet seats) has prevented a positive attitude from prevailing.

As Dr. Rosebury explains in his provocative book, VD isn't something to be found in the open. If doctors are reluctant to snoop, to pry, to probe deeply, and if patients sequester vital statistics on their sexual contacts or attempt to cure themselves because they fear moral censure, the public health officials (who are the heroes of the story) can do little to combat the ailment.

Dr. Rosebury's book is dedicated to the idea that VD is completely curable. But morals must be attuned to reality before these microbes will be destroyed.

—*Michael J. Bandler*
Environmental reporter and reviewer

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(signed) Joseph J. Bonsignore
General Manager

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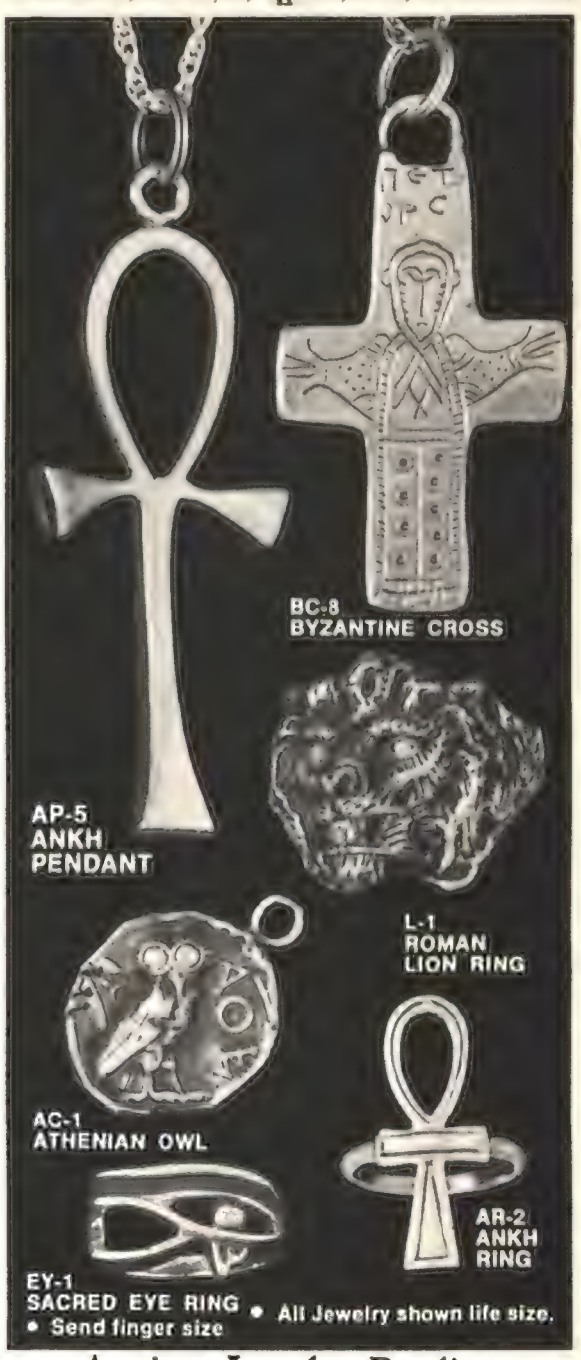

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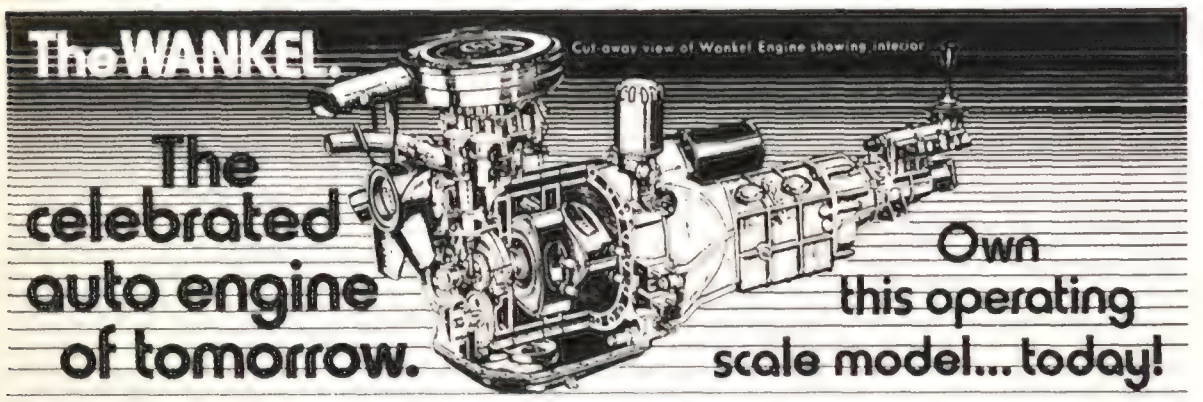
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Smithsonian highlights

Museum of Natural History
"A Century of Research and Science in Fisheries," an exhibit sponsored by the Departments of Commerce and Interior, commemorates the 1871 appointment of then Assistant Smithsonian Secretary Spencer F. Baird as the first U.S. Commissioner of Fish and Fisheries and covers the history of the conservation of fish.

Freer Gallery of Art
"Chinese Landscape, Blue and Green," a lecture by Professor Martie Young of Cornell University, will be presented on November 9 at 8:30 P.M. in the Gallery Auditorium.

"Eugene and Agnes E. Meyer Memorial Exhibition" includes mainly Chinese bronzes, jades, sculpture, paintings and ceramics. Many of the 32 objects have not previously been exhibited. An illustrated catalog is available.

Museum of History and Technology
"Early Electrical Appliances," an exhibit of old household items including toasters, irons, fans and eggbeaters, has opened in the Hall of Electricity.

"General Store Post Office" has been set up just as it was in Headsville, West Virginia, in the early 1860s and will operate as a post office with a postmaster in period costume dispatching mail with a Smithsonian postmark.

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Arts and Industries Building
"Balloons" depicts the total history of balloons from how they were invented to future possibilities, covering forms, fabrics and functions. Opens mid-November.

The Apollo exhibit includes a flight-weight, operational, back-up Lunar Module. (See SMITHSONIAN, October 1971)

Division of Performing Arts
"Tom Sawyer" is being presented by the Allan Stevens company with 15 new puppets and a newly adapted script at the Smithsonian puppet theater daily, Wednesday through Sunday. For ticket information call 202-381-5395.

National Collection of Fine Arts
"William H. Johnson (1902-1970)" includes 150 paintings, watercolors, drawings and prints in the first major museum exhibition accorded this black American artist. (See p. 34.)

"Thomas Eakins: His Photographic Works" presents some 200 photographs of or by this 19th-century American artist, including portrait photographs used for paintings and examples of the artist's outdoor work. Opens November 19.

"Lee Gatch (1902-1968)" is a selection of some 30 works showing Gatch's progress from stylized abstraction to collages of stone on canvas. Closes November 14.

Associates Events
"Ecological Effects of Herbicides in Vietnam," an illustrated lecture by Dr. Matthew Meselson, professor of biology at Harvard University, will be presented on November 9 at 8:30 P.M. in the Natural History Auditorium. Doors will be open at 8 P.M.

Traveling Exhibition Service
More than 70 Smithsonian-sponsored exhibitions open each month throughout the United States and Canada. For a complete listing write: Traveling Exhibition Service, Smithsonian Institution, Washington, D.C. 20560.

- Muskegon, Michigan—"Paintings by Frederick J. Waugh" (The Hackley Art Gallery, November 6-December 5).
- Stanford, California—"Prints and Drawings by Lovis Corinth" (Stanford University, November 13-December 12).
- Decatur, Illinois—"Graphics '71: West Coast, USA" (Kirkland Fine Arts Center, November 6-December 5).
- Kutztown, Pennsylvania—"Color Prints in Series" (Kutztown State College, November 13-December 12).
- Austin, Texas—"The Graphic Art of Felix Vallotton" (University of Texas, November 6-December 5).
- Montgomery, Alabama—"Objects to Wear" (Montgomery Museum of Fine Arts, November 13-December 12).
- Muncie, Indiana—"Dead Sea Scrolls" (Ball State University, November 13-December 12).
- Warrensburg, Missouri—"Rock Paintings of Tassili, Sahara" (Central Missouri State College Museum, November 6-December 5).

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National Portrait Gallery
"Model Hall," once the largest room in the United States, used to display patent models until 1932, is now open to the public. Clara Barton and Walt Whitman nursed Civil War soldiers there and Abraham Lincoln received guests in the rotunda during his second inaugural ball. "The Monarch Prints," a collection of portrait prints of rulers important to the history of America, are on exhibit.

"Washington from Banneker to Douglass: 1790-1870" is an exhibition that includes portraits, photographs and documents presenting the black community's view of the history of Washington, D.C.

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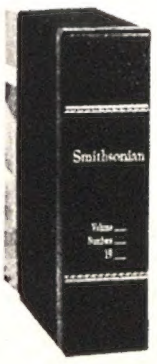

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The great liar, Baron Munchausen, after Gustave Doré

By Patrick Ryan

Trip the lie fantastic and outwit the polygraphs

From Fifth Avenue comes a faint glimmer of hope for the declining dignity of Man. The president of Bonwit Teller has announced that the store is abandoning its experiment with lie detectors, which was tried in the hope of reducing stock losses by inside pilferage. This decision will gladden the hearts of all who share repugnance to any authority's abasement of human beings by inhuman machines. After 30 or so polygraph interviews with volunteers from the store's staff, the president said, "Our testing of the test proved it was ineffectual for our purposes."

That finding enjoys prior support from sages of scientific detection who have doubted the reliability of the lie detector and concluded that its effects, such as they may be, are in the main psychological. The victim, impressed by the technical bonds lashed about him and the array of recording pens, is intimidated into self-incrimination. Experts doubt the operational validity of the polygraph, courts of law won't swallow its "testimony" whole, and some lay sceptics question the desirability of its basic objective. The puritan concept that virtue lies in the ungarnished statement of supposed fact has enjoyed a length of sway unjustified by its contribution to either liberty or happiness. It is only the gentle and sympathetic art of white-lying that makes life livable, marriage tolerable and peace possible. The callous delivery of what is in the mind without some sweetening of sensible kindness is an act of barbarity rather than honesty. Truth, observed Christopher Morley, is not properly a diet but only a condiment.

What will it profit a truth-hooked husband when his wife comes downstairs all dolled up for the ball and asks, "How do I look?" if he frankly replies "Terrible"? And when he relates to her at eventide the bitter injustices of his business day, would either's cup be fuller of content if she looks him straight in his rationalizing eye and says, "Look, buster, let's face the fact that I married a failure." Whither would go commerce, how fare diplomacy, and what price peace on Earth if no one ever tempered cold exactitude with lenitive charity? More bones have been broken by excessive candor than by fanciful embroidery and many noses bloodied by an overdose of veracity that might have been preserved untapped by a modicum of blarney. Josh Billings had a point when he noted that no matter how scarce the truth is, the supply always exceeds the demand. Pontius Pilate took the debate a little deeper when he asked "What is truth?" but stayed not for an answer. Perhaps he simply reasoned that there are but two certain truths here below—birth and death—and all between must needs be compromise.

Neither such aphorism, however, nor the liberal head of Bonwit Teller is likely to deflect the stern polygraphists from their bleak pursuit. A resistance movement should be organized against these technical Torquemadas of today. The lie detector is basically a device for measuring and recording such variable bodily functions as pulse rate, blood pressure and respiration. Its findings depend upon establishing norms with innocuous questions and registering the fluctuations in response to relevant queries. Resolve, therefore, to lie consistently from the first moment they strap you up to the pneumograph, tighten the pulse-cuff and cross your palm with electrodes. As soon as the man from Kafka starts his probe, prevaricate steadily and monstrously like Ananias, Munchausen and Goebbels rolled into one. In answer to every question, whether innocent or incriminating, give back the lie circumstantial, the lie direct and the lie fantastic with firebells dinging from every extremity. Produce invented skeletons from your private cupboard fit to horrify De Sade and sicken Genghis Khan. Surfeit the polygraph with falsehood, set its serried pens tangling in seismic frenzy, and go on coughing up whoppers till the thin blue smoke of nervous breakdown wisps up from its electric entrails.

Such blitzkrieg tactics, besides protecting any truly guilty secrets you may cherish, could also serve to bring you unexpected material prosperity. On publication of your polygraph-blistering performance, a clamor of competition for your services would beat up from among the many professions in which the prime qualification is the ability to turn a delicate lie. New careers could open to you as public relations man, used-car dealer, theatrical agent, real estate peddler, confidence man or other of those lucrative livelihoods requiring a talent for bending the truth. And, of course, if your fabricating abilities were so consummate as to make the lie detector burst into open flames, you'd be certain to hit the road to the stars as a politician.

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